Elizabeth River Restoration

LEADERSHIP REVIEW DRAFT

Elizabeth River Project

Elizabeth River

Restoration

A Watershed Action Plan

to Restore the Elizabeth River

Leadership Review Draft

April 26, 1996

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Prepared by the Elizabeth River Project's Watershed Action Team

In Partnership with the Commonwealth of Virginia

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Preface

"It's easy to observe that in many respects,
the history of our nation
is intertwined
with the history of the Elizabeth River."

Former US Senator
William B. Spong Jr.,
Portsmouth

What the Elizabeth has given the nation

Excerpted remarks by former US Senator William B. Spong Jr. at the Elizabeth River Project conference, "Elizabeth River Visions," Oct. 22, 1993, Norfolk Waterside Marriott. A Portsmouth attorney, Spong is former dean of the Marshall Wythe School of Law at the College of William and Mary and former president of Old Dominion University.

In September of 1608, scarcely 18 months after Jamestown had been settled, **John Smith and 12 sailors in a long boat** crossed Hampton Roads and entered what we know today as the Elizabeth River. They went six or seven miles, we are told, and they noticed two things of some significance. One, they saw traces of previous habitation, but along this trip they saw no Indians. Secondly, they witnessed the large fir and pine trees on the banks of the Elizabeth.

Some time later, we have the first record of someone seeking use of the Elizabeth River, when a man named John Wood petitioned a London company for land to build a shipyard on the banks of the Elizabeth River. The same year, 1620 **-- about the time the pilgrims were settling Plymouth Rock --** William Tucker

petitioned for several acres of land at Sewell's Point, now the site of the Norfolk Naval Base.

A site for Norfolk on the Elizabeth River was purchased and laid out as a town in 1687. On the other side of the Elizabeth, a man named William Carver had petitioned and patented for the land there on which now stands Portsmouth. Carver was not very smart, politically, and joined Bacon's Rebellion, which failed. He was rewarded for his efforts by being hung in the Chesapeake Bay.

His land was given to a man named Colonel William Crawford in 1716, who laid out Portsmouth as a town. The first settlers in the two towns had come across the James River and Hampton Roads to settle in what became Princess Anne and Norfolk counties. Moving into the towns as shipping, shipbuilding, and commerce developed, three quarters of the town lots in Norfolk and Portsmouth were occupied by those employed in some type of maritime endeavor. The (House of) Burgesses established Elizabeth River Parish and the site of its first church was near the present location of St. Paul's Church.

Also in 1636, the **first known public utility** in America went into operation when Adam Thoroughgood established the first ferry. I came across this morning on it successfully (Tidewater Rapid Transit's Elizabeth River Ferry, operating between Portsmouth and Norfolk), takes about eight minutes, it's cheap, I recommend it to you.

"In 1636, the first known public utility in America went into operation .... I came across this morning on it successfully (Elizabeth River Ferry), takes about eight minutes, it's cheap, I recommend it to you."

As the towns grew on either side of the Elizabeth River, the Scotch merchants - shrewd, frugal, canny, and knowledgeable of trade by sea, emerged as the most affluent and influential group in the area. These merchants were Tories and as the American Revolution approached were loyal to the crown. I'm going to talk for a moment about one of them. His name was **Andrew Sprowle**. He started business in Norfolk, moved across the river to Portsmouth, purchased one of William Crawford's lots right on the Elizabeth River, and set up a private mercantile business. In time, he purchased all of the land south of Portsmouth, down toward the area that Dr. (William) Hargis (former director, VA Institute of Marine Science) has been discussing as hardest on our fish, and he built a shipyard. He named that community Gosport, very similar to Portsmouth, England, where you have the city of Portsmouth and Gosport where the navy yard is located.

Soon he was servicing not only private craft, but the British Fleet. The **American Revolution** came along, and Andrew Sprowle now was a great friend of the Colonial governor of Virginia, Lord Dunmore. When Dunmore fled Williamsburg, where did he head for? He headed for Gosport, and Sprowle put him up; his headquarters were where the British ships were.

Dunmore occupied Norfolk. He took over most of the region, using Gosport as his headquarters. And then, learning that the American patriots were descending on this area from Williamsburg and from the west, he went out to meet them at what we today know as Great Bridge. **A tremendous battle was fought. Among the soldiers was a very young John Marshall.** The Americans prevailed. Dunmore fled back into Norfolk in great disarray.

Shortly thereafter, Norfolk was burnt to the ground. There has been ongoing argument for years about who did this. I'll give you a composite of the best information I have. The guns from Dunmore's ships laid low the waterfront and about thirty-two of the 1,200 houses in Norfolk. The remainder of the houses, over 1,000, were burned either by the American patriots -- who were, first, angry with the Scotch Americans and wanted to get even with them for siding with the crown, or, secondly, by those of a military bent, who **did not want the British to have Norfolk as a center from which to sail. Norfolk was burned to the ground;** Dunmore retreated again to the other side of the river, and this time he occupied a position on Hospital Point; you can see it when you walk out of here.

He put his troops there, such that he had left, and 1,500 or so Tories who assembled to flee with him. He could not maintain a presence there for very long, and soon they all boarded the ships and went to Matthews County -- where Dunmore was again defeated and the Tories and the Scotch merchants were dispersed back to London, to Bermuda, or to Nova Scotia. Andrew Sprowle died at the battle fought in Matthews County.

Now we, today, regard **Thomas Jefferson**, and we should, as one of the greatest Americans. And he was, but he had his bad moments. And those moments mostly concerned his time as governor of Virginia, when he seemed completely incapable of keeping the British crafts out of the Elizabeth River during the American Revolution. Despite all types of warnings, Jefferson did very little. And as a result, three different British expeditions sailed into the Elizabeth River and landed at Portsmouth. Norfolk, you will recall, was burned to the ground; there was nothing over here at the time. The first expedition was in 1779, the second in1780, and the third in 1781, commanded by, of all people, Benedict Arnold, who had switched sides. The British sent him down here with a large force to join up with Cornwallis, coming from the south, to take over the Virginia province. Cornwallis met the force that had been under Arnold around Petersburg, and after awhile they withdrew to Portsmouth.

Cornwallis didn't like Portsmouth, but he liked it better than anything else they had encountered ... he had to choose between setting up at Old Point Comfort or going to Yorktown. He went to Yorktown, and all of you know what happened as a result there. He was headquartered right on the Elizabeth, and then left in 1781 to meet his fate at Yorktown. After the Revolution was over, the Scots returned to the area almost immediately. Norfolk was destroyed, so they showed up in Portsmouth, and the people of Portsmouth, with their usual good judgment, ran them out of town. They would not allow the Scots to settle there, and so they came over and rebuilt Norfolk. The patriots were starving out in Princess Anne County and lower Norfolk County, but the Scots in a short time were thriving again back in the ruins of Norfolk.

Now the amount of trade that sprung up by 1801 or 1802 is almost unbelievable. There were so many ships in the harbor out here that the ferry boats had trouble getting back and forth. Millions of dollars in foreign trade was taking place ... Unfortunately, the port thought this prosperity would last forever, but the war came between England and France, the Napoleonic Wars, and the trade with the West Indies that the port of Norfolk had enjoyed so much began to be threatened. First, French privateers began attacking the American vessels and taking them over. Secondly, the British, believing there were British seamen aboard the American ships that had deserted from the British Navy -- and there were -- began boarding the American vessels and taking the British seamen off, and impressing others into service in the British fleet.

Then Jefferson; and this is a bad day for my hero, his solution to all of this, and to the French and British War, was to declare an embargo which stopped all shipping in and out of this port anyway, and killed what would have been a very profitable trade. Well, the war between France and Britain was settled, but the impresssment of seamen and other things caused another conflict.

The first thing that happened, the Chesapeake, which had been built at the Gosport Yard, went out from this harbor and about 12 miles from Cape Henry was confronted by the British frigate Leopard. The Leopard, firing on the Chesapeake, stopped the Chesapeake; wounded some of the men on board; took four sailors off, three of them were Americans and one was British -- and the Chesapeake, gravely wounded, limped back into the Elizabeth River to the great embarrassment of this entire nation. The commander of the Chesapeake was Commodore (James) Barron. Steven Decatur, another naval hero, accused Commodore Barron of not facing up to the British. Commodore Barron challenged him to a duel. They meet outside of the state (Bladensboro) and Commodore Barron shot and killed Commodore Decatur. Barron lived a long life in Norfolk and is buried over in Trinity churchyard in Portsmouth.

As a result of this, another war began, and in 1813, four years after the encounter between the Chesapeake and the Leopard, another British squadron showed up in the Elizabeth River. **They landed a tremendous force at Craney Island.** The troops from Portsmouth and Norfolk went out and met them and defeated them. People in this area had been prepared to meet the force with guns on Hospital Point and at Fort Norfolk, but the British were defeated before they ever got that far into the river.

It's been observed that, had the people in Washington met the British with the same enthusiasm as those in this area did in defeating them, Washington would have never been burned and captured.

Now I'd like to hurriedly review for you just a few of the events affecting the Elizabeth River that occurred after the War of 1812 and during the 19th Century. In October of 1820, the Delaware was launched at the Gosport Navy Yard. It was the first of a large number of battleships constructed at that yard. Andrew Sprowle's private yard had become a federal shipyard in 1801.

In 1828, the Dismal Swamp Canal was finally opened after several years of construction. It did not enhance foreign trade, but did provide an easier method of coastal trade from North Carolina to the cities of the north. The Norfolk papers said: "The canal is invaluable. It has staved off ruin. **But it will take more than a**

ditch through the Albemarle Sound to make Norfolk a second New York." In 1859, a second canal, the Albemarle and Chesapeake, was opened.

In June 1833, after six years of construction, the first stone dry dock in America was opened at the Gosport Navy Yard.

In June 1855, the steamer Ben Franklin, in route from St. Thomas to New York, entered the Elizabeth River for repairs at Gosport. Yellow fever mosquitoes were in the hold. Within days, there was an epidemic that killed off over 3,000 people in Norfolk and Portsmouth.

"In January of 1857, the temperature dropped to nine degrees below zero and the Elizabeth River froze over. Horses and pedestrians could cross with ease from Norfolk to Portsmouth and from Portsmouth to Norfolk."

In January of 1857, the temperature dropped to nine degrees below zero and the Elizabeth River froze over. **Horses and pedestrians could cross with ease** from Norfolk to Portsmouth and from Portsmouth to Norfolk.

The ports had never reached the potential that many had foresaw for it. The canals leading into the Elizabeth River were too narrow; the railroads running out of Baltimore, Philadelphia, and New York had developed rapidly, due to superior transportation connections. While the port at Norfolk had been thwarted by Richmond interests, the frustration of those seeking to develop the port were such that resolutions were drawn reviving a century-old theme that the towns on the Elizabeth River should become a part of North Carolina.

The Civil War approached. Both Norfolk and Portsmouth elected delegates to the Secession Convention who wanted Virginia to remain in the Union. But Lincoln's announcement that he would start a war to preserve the Union moved the Virginia convention to secede. In April of 1861, the Gosport navy yard was the largest navy yard in the United States, and one of the largest in the world, and the Union forces were determined not to let the ships in the navy yard fall over to the Confederate forces. **The Confederates began sending troops into Norfolk** and William Mahone, who had constructed what is today the Norfolk Southern railroad into Norfolk, was a general. He had perhaps four regiments that he was moving into Norfolk overnight. **He rode them in on cars, standing up. Then they would come out laying down in the cars, so no one could see them.** The man in the crow's nest of the Delaware, in the navy yard, watched all night, reporting to Washington that 10,000 to 20,000 troops had moved into Norfolk overnight, counting those same 800, going in standing up, and coming out, laying down.

Finally, the man in charge of the navy yard panicked. Despite the fact that under a flag of truce, they had come over to Norfolk and assured the Confederates that the 11 large ships would not leave the harbor, they panicked; with all the home troops going into Norfolk, and they burned the navy yard, and they burned all 11 of those ships, among them the frigate Merrimac. As all of you

know, the Merrimac, a wooden vessel, was brought up and made into one of the world's first iron-clads. A year later, in March of 1862, the Merrimac went out into Hampton Roads and was in the process of destroying the federal fleet there when the Monitor appeared and the famous battle between the iron-clads took place.

That battle was a stand off. The Merrimac's effectiveness was limited to what it could do in the Elizabeth River and Hampton Roads. It was unseaworthy and could not have gone beyond Hampton Roads. At the same time Roanoke Island fell to the Union forces. That outflanked the City of Norfolk. It meant that Norfolk was sitting there to be taken by the Union Army at any time. The Confederates withdrew, and as a result, this harbor, during the war was blockaded as well as occupied by the Federal forces.

I have only given you some of the events, sketchily and briefly, that have happened to the Elizabeth River, but it's easy to observe that in many respects, the history of our nation is intertwined with the history of the Elizabeth River. Sprowle's private shipyard has become the **oldest, largest and best naval shipyard in the United States.** Sewell's Point, first purchased back in 1620, has become the site of the **world's largest naval base**. Hospital Point is the site of the **oldest naval hospital**.

Aside from the military buildup that has taken place, Mahone's railroad coming into Norfolk, its expansion fought so vigorously by the forces in Richmond, has become important in Norfolk, and is today the Norfolk Southern Railroad. The port facilities have been developed, with terminals on all sides, and the largest coal facility in the world.

I have talked about the river's past and you are here today to discuss the river's future. How economic development, which has had so much of a struggle throughout the centuries to come to any fruition, and how the necessary military structure can be maintained, and at the same time the river maintained, is a tremendous challenge. I commend you for undertaking that challenge, and I hope that somewhere there are lessons in the past that will help us in the future.

"How economic development, which has had so much of a struggle throughout the centuries to come to any fruition, and how the necessary military structure can be maintained, and at the same time the river maintained, is a tremendous challenge. I commend you for undertaking that challenge ..."

Introduction

Overview

The Watershed Action Plan completes a crucial planning phase for the Elizabeth River Project in carrying out its mission of a cleaner Elizabeth River, but by no means represents "the end of the road." The Elizabeth River Project was founded *"to form a partnership* among the communities and all who earn their living from the river, *to raise appreciation* of its economic, ecological and recreational importance, ***and to restore the Elizabeth River system to the highest practical level of environmental quality"*** (mission statement 1993).

Achieving urban watershed restoration requires thousands of committed people and organizations working patiently over several decades to carry out hundreds of initiatives. The goal of the Elizabeth River Project is to see this long-term effort to fruition. A wide spectrum of interests has been represented both on our Comparative Risk Committees, as they reached agreement on the river's problems in 1994, and on our Watershed Action Team as it set recommendations in 1996. Our committees and intervening public conferences have set forth a promising road map for restoring environmental quality.

Now the Elizabeth River Project proceeds to the next task: bringing environmental restoration to reality by initiating implementation of the Watershed Action Plan.

While the independent, non-profit Elizabeth River Project does not have the resources or the authority to carry out large-scale improvement projects directly, our Board of Directors is committed to serving in a catalyst role to see that the recommendations of the Watershed Action Team are implemented by those with the most appropriate authority and

capabilities. The project has proven successful in this role already by virtue of its commitment to bringing all parties to identify common interests.

The Honorable Becky Norton Dunlop, VA Secretary of Natural Resources, has pledged her commitment to giving "every consideration" to implementation of the plan. The state provided almost $100,000 in direct and contracted support to develop the recommendations. The **EPA's Chesapeake Bay Program** has budgeted more than $80,000 for the Elizabeth River Project to implement the plan, including money for a wetlands restoration we will carry out in partnership with the City of Norfolk.

Congress has authorized a $400,000 study of projects the **US Army Corps of Engineers** could implement related to the plan (funding pending). The 1996 **VA General Assembly** approved $250,000 for increased monitoring and $200,000 for removal of derelict vessels in the Elizabeth River over the next two years. The passenger schooner, **American Rover**, is starting Elizabeth River education for school children.

Our fundamental challenge is to keep the momentum going. We look to you as the essential ingredient for the success of the actions that follow.

Join us in achieving our Watershed Action Team's vision of a river that:

~ **Nourishes and sustains** a wide variety of economic and public uses,
~ **Supports** a healthy and diverse ecosystem, and is
~ **Actively and responsibly managed** by an educated citizenry and a partnership of river users.

Vision statement,
June 12, 1995

State of the river

The Elizabeth River provides bountifully for Hampton Roads, in economic terms. She is the magnificent setting for attractions such as Norfolk's new National Maritime Center, Nauticus and Harbor Park ballfield. She is one of the world's busiest shipping highways, carrying not only the world's largest military fleets, but the foreign ships of an expanding commercial port. She hosts thousands of recreational boaters on the Intercoastal Waterway and hundreds of thousands party on her shores during Harborfest.

At the same time, the Elizabeth River remains one of the more seriously degraded urban rivers in the United States. Originally a broad, shallow estuary of the Chesapeake Bay, the river has been dredged to twice her normal depth and filled to two-thirds her normal width to accommodate three centuries of development. Toxics accumulating in the river's muddy floor have been correlated

with health problems in fish, including tumors, cataracts and other abnormalities, and may cause risks for human health as well. As much as 50 percent of tidal wetlands have been lost on the Elizabeth River since World War II.

Many of the river's problems have abated with the rise in environmental consciousness of the last decades. Industrial discharges into the river are extensively regulated and significantly cleaner. Municipal improvements include a state-of-the-art sewage treatment plant. Large challenges remain for the 300-square-mile watershed, however.

The most serious risks currently facing the Elizabeth River watershed were ranked in 1994 by diverse committees of the Elizabeth River Project. Eighty representatives from citizen, business, government and scientific interests met for seven months to analyze and debate the river's problems in a project funded by the US Environmental Protection Agency and the Virginia Environmental Endowment. These "Comparative Risk" committees agreed on four problems posing a "high risk" to human health, quality of life and the ecosystem in the Elizabeth River watershed: **1) sediment contamination, 2) loss of habitat and aquatic life, 3) non-point source" pollution,** arriving from many diffused sources, primarily stormwater runoff; **and 4) "point-source pollution,"** involving discharges from industrial facilities.

In technical studies for this Watershed Action Plan, URS Consultants in 1995 further identifed stormwater runoff as responsible for as much as 88 percent of heavy metals entering the river, and as much as 99 percent of another leading river culprit, polycyclic aromatic hydrocoarbons (PAH's).

The Comparative Risk Committees also expressed an **over-arching concern for human health risks** associated with the Elizabeth River. The committees advised against near-shore swimming in the river, or working or wading in the mud of the Southern Branch, due to contaminants. Bacterial counts are too high for consumption of shellfish directly from the river. The risk of cancer due to ingestion of PCB-contaminted fish is significant and has been calculated at 1 in 10,000, using limited data from the Southern Branch.

Our committees have consistently been concerned with **environmental justice** issues as well. On the Elizabeth River, these seem to go hand in hand with human health concerns. Some population groups are more at risk of illness from the river than others, including those engaged in recreational boating or subsistence fishing, and pregnant women or nursing mothers who eat fish or shellfish from the river.

History of the plan

This Watershed Action Plan is the result of the Hampton Roads community **taking responsibility for our own environmental challenges,** with timely government help.

The non-profit Elizabeth River Project was hatched in 1991 by four local citizens around a kitchen table. Their premise: This river's large problems will not be solved by government alone, but by a new level of **community stewardship.** In

1994, with funding from the US EPA and the private VA Environmental Endowment, the Elizabeth River Project steered 80 volunteers from all walks of life through a seven-month process of analysis and debate leading to **agreement on the river's worst problems.**

Meanwhile, the tri-state Chesapeake Bay Program designated the **Elizabeth River as one of three toxic "Regions of Concern"** on the Bay. On October 14, 1994, Virginia Gov. George F. Allen signed a commitment to lower toxics in these regions of concern.

The State turned to the Elizabeth River Project for stakeholder recommendations. In March 1995, the Elizabeth River Project **entered a partnership** agreement with Secretary of Natural Resources Becky Norton Dunlop. State funding was provided for the Project to develop recommendations on toxics reduction as an integrated part of a larger Watershed Action Plan of the Elizabeth River Project's EPA-sponsored planning process. Actions address not only toxics, but also the "high risk" problems of sediment contamination, habitat loss, point-source and non-point source pollution.

A 120-member Watershed Action Team kicked off on April 27, 1995. Over the following year, the team worked in four taskfoces: a Habitat & Living Resources Task Force, a Sediment Quality Task Force, a Water Quality Task Force and a Toxics Reduction Team. Members represented the spectrum of business, government, citizen and scientific concerns. These volunteers developed hundreds of pages of discussion papers before achieving consensus Feb. 29/March 1, 1996. Consultants also provided background reports. Actions were chosen based on three criteria: **effectiveness, affordability and acceptability** to the communiy. Each action recommended was judged to be effective in reducing high-risk problems of the watershed. For each, it was thought reasonable that funding could be found and benefits appeared to outweigh costs. Each was considered acceptable enough to reach implementation, although acceptability was hardest to guage. The Elizabeth River Project mailed 1,000 questionnaires on acceptability in winter 1995 and established a **Leadership Review Board** to obtain input from the highest levels of authority, influence and knowledge on river issues.

Critical areas

The Action Team identified the following as "critical areas" deserving the most resources at this time:

Action 1 - Reduce sediment contamination;
Action 2 - Increase wetlands, vegetated buffers and forested areas;
Action 5 - Engage in pollution prevention and sustainable landscaping;
Action 6 - Reduce pollution from stormwater runoff;
Action 14 - Establish an Elizabeth River monitoring program and data bank.

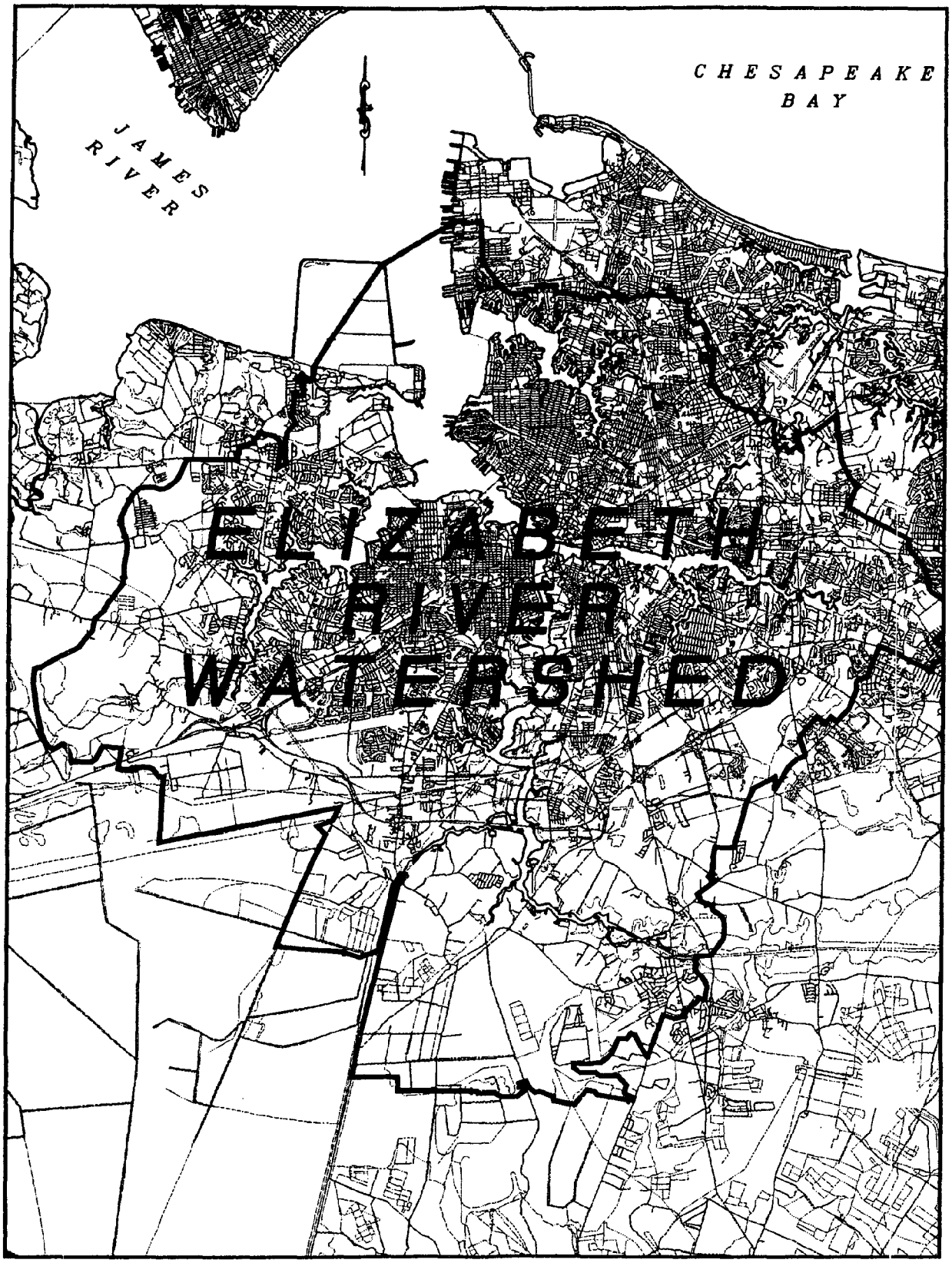
The team recognizes these as **key actions for the health of the river,** although the team also expressed concern that too much emphasis on a few priorities could weaken the integrated watershed approach that is a key strength ofthe Action Plan. "Restoration is different from habitat creation, reclamation andrehabilitation -- its a holistic process not acheived through the isolated manipulation ofindividual elements," according to the National Research Council (Restoration of Aquatic Ecosystems, 1992).

The Team strongly recommends that implementation move forward with all 18 actions. All 18 met the test of the team's criteria: affordable, acceptable and effective.

"Restoration is different from habitat creation, reclamation and rehabilitation -- it is a holistic process not achieved through the isolated manipulation of individual elements."
Restoration of Aquatic Ecosystems, National Research Council, 1992

ACTION AGENDA

"We applaud the broad public involvement in the Elizabeth River Project and the orderly progress toward cleanup."
The Virginian-Pilot, editorial, Jan. 22, 1996


CHESAPEAKE
BAY
JAMES
RIVER
ELIZABETH
RIVER
WATERSHED

Section I: Addressing past harm

Goal: *To restore the health, aesthetics and diverse ecosystems of the Elizabeth River.*

"The highest levels of shellfish and finfish contamination in the Chesapeake Bay were observed in the Elizabeth River and in the Baltimore Harbor."
Elizabeth River Regional Action Plan for Toxics Reduction,
Draft Report, Nov.30, 1995

Action 1

Reduce sediment contamination in the Elizabeth River to levels non-toxic to humans and aquatic life, remediating the highest priority contaminated sites by the year 2010.

Steps for getting there:

1996 - 2010

Step 1: Establish an on-going relationship between the Elizabeth River Project, the US Army Corps of Engineers Elizabeth River Basin Study, and the EPA Superfund Program, for the purpose of promoting speedy, effective implementation and public understanding and support for *the following priority objectives*:

- ❖ Identify areas where sediments are determined to be the most contaminated and select best alternatives to remediate them, using guidelines in the EPA Handbook for the Remediation of Contaminated Sediments (EPA, 1991).

- ❖ Conduct a demonstration remediation at one of the most contaminated sites.

❖ Remediate the highest priority contaminated sites by 2010. This must be pursued as one part of an integrated watershed initiative also addressing upland sources of contamination.

By 1996

Step 2: Support development of "in situ" bioremediation technology by the Virginia Center for Innovative Technology and the University of Virginia's Department of Chemical Engineering.

By 1997

Step 3: Demonstrate sediment remediation techniques in a creek or small waterway as part of an integrated demonstration project also modeling other actions proposed in the Plan. Several task forces have identified the general area of Paradise Creek as promising for such a demonstration effort.

By 1998

Step 4: Establish Sediment Quality Guidelines to provide consistent, objective guidance on levels at which sediments are considered contaminated. VA Department of Environmental Quality could be approached to become the lead agency for this. Initial guidelines should be adopted from other efforts such as those of NOAA or the State of Florida, although some benchmarks for the Elizabeth already exist. Over time, comprehensive guidelines for the Elizabeth River could be adopted as part of the comprehensive monitoring and data collection program outlined elsewhere in the Plan. Sediment quality guidelines are proposed as an essential aide for making sound decisions, but are not intended to have the weight of regulatory standards. ***(originally proposed as a separate action)***

Background action 1

Problem addressed:

High levels of pollutants accumulating over centuries in the muddy bottom of the river have been linked to health problems in fish, including tumors, cataracts and abnormalities, and may pose health risks for humans as well. Sediment contamination is one of four high-risk problems identified in 1994 by the Elizabeth River Project's Comparative Risk Committees.

Stressors reduced:

Heavy metals including cadmium, chromium, copper, lead, mercury, nickel and zinc, toxic organic compounds dominated by fossil fuel-based combustion products/byproducts called polycyclic aromatic hydrocarbons or PAHs, plastic related chemicals called phthalates, and other industrial chemicals such as polychlorinated biphenyls or PCBs, other chemical contaminants including oxygen-demanding organic chemicals, and pathogens.

Estimated costs:

Costs depend on many factors including engineering, permitting, quantities of sediment to be removed, transport distances, treatment measures and method of disposal. Dredging as a means of remediating contaminated sediments is roughly estimated to be in the range of $6 to $8 per

cubic yard, provided a confined disposal facility is available. If a confined disposal facility is not available, costs may escalate significantly. Capping is considered to be roughly comparable. Costs for on-shore bioremediation treatment range from $50 to $200 per cubic yard, and require dredging and an on-shore treatment facility.

Indicators for measuring success:

Health, population and diversity of benthic biota, levels of sediment contamination, percentage of high-priority contaminated sites remediated.

Discussion of Step 1:

The US Army Corps of Engineers has received Congressional authorization (funding pending) for an Elizabeth River Basin Study as part of its on-going Environmental Restoration Program. This is a *cooperative effort* co-sponsored by the Commonwealth of Virginia with endorsements from the Cities of Portsmouth, Chesapeake, Norfolk and Virginia Beach. The study will build on findings of the Elizabeth River Project, which solicited the Corps' involvement and actively encouraged local and state cooperation with the Corps.

The first phase of the Corps program will be a reconnaissance study which, in part, should address remediation of contaminated sediments. This reconnaissance will be followed by a comprehensive feasibility study and design and implementation phases. In the later phases, the local and state governments will be asked to consider sharing costs (25 percent shared by local and/or state sponsors; 75 percent by the federal government).

The Corps program is viewed as the most effective, affordable and acceptable avenue for carrying out the major steps needed for sediment remediation in the Elizabeth River watershed, including identifying the most highly contaminated sites, selecting the best alternatives to remediate them and carrying out remediation. The pace at which the Corps is able to proceed is currently dictated by federal policy. The pace can be accelerated by Congress. It is recommended that the Elizabeth River Project establish an on-going relationship with the Army Corps of Engineers, Norfolk District, to provide public understanding and support for *speedy, effective implementation of mutual objectives*. The requirement for cost-sharing the design and implementation of sediment remediation projects should enable municipalities to express the needs of their citizens and local interests.

In a separate effort focusing on the *Atlantic Wood Industries*, Inc., Superfund site in Portsmouth, the US Environmental Protection Agency, in consultation with the VA Department of Environmental Quality, has issued a Proposed Remedial Action Plan to present EPA's Preferred Remedial Alternative for Operable Unit 1 of the Superfund Plan; cleaning up surface soil, sediment and Dense Non-Aqueous Phase Liquid contamination at the site (EPA, June 1995).

With the exception of cleaning up sediments in a small inlet at the mouth of a storm drain, this effort does not address the remediation of contaminated sediments located in the river bed offshore of the site. The proposed Superfund plan indicates such action will be included in later steps. It is recommended that the Elizabeth River Project offer to assist in this effort and recommend actions now in order to expedite remediation of offshore contaminated sediments. Perhaps the Superfund effort could be coordinated with the Corps program and the costs shared.

Based on data available, the likeliest areas of high contamination by toxic organic compounds are offshore of past wood creosote treatment facilities and possibly oil terminals and shipyards **(a fuller explanation is included in the discussion paper, "Remediate/Remove Contaminated Sediments," developed for this plan and available separately)**. The preferred alternative would be to remediate the toxic organic contamination at these sites using "in situ" biodegradation technology. In situ means the remediation takes place without removing the sediment from the river. If the site is contaminated with heavy metals, then capping, containment in geotextile containers or removal and treatment may be necessary. If removal, treatment and deposition are required, then on-shore facilities and some confined disposal facility capability will be needed. The regulations pertaining to the Craney Island Disposal Area either need to be

changed to accept contaminated (possibly treated) sediments from non-navigable areas or other facilities need to be created. If sites are contaminated with both toxic organic compounds and heavy metals, more than one approach may be necessary.

A concern during the removal and transport of contaminated sediments is the danger of introducing contaminants into previously uncontaminated areas. Contamination during these steps occurs primarily from the resuspension of sediments during removal, from spills and leaks during transport, and from leaching during dewatering. Accordingly, non-dredging remedial options, including in situ containment or remediation, may be more acceptable to the public and should be thoroughly considered.

Discussion of Step 2:

The concept of remediating sediments *"in situ,"* or without removal from the river bed, is very appealing for applications such as the Elizabeth River, where there are many areas contaminated with organic compounds, often in shallow waters. The disadvantages of other alternatives requiring removal, transport, treatment, and disposal can be avoided. There should not be any resuspension of contaminated sediments, treatment of contaminated sediments should require less effort although may take longer to accomplish, and costs may be less than many alternatives. However, this is an emerging technology with few in situ applications.

Recent development of an *in situ bioremediation technology* by the Virginia Center for Innovative Technology (CIT) and the University of Virginia's Department of Chemical Engineering (DCE), with contracted assistance, shows promise. Bioremediation relies on indigenous or introduced bacteria to degrade organic compounds in soils or sediments. In this case, bench tests found that anaerobic bacteria transported to the bottom in porous silicon beads migrate outward as they feed on organic contaminants, converting them to harmless byproducts. The sponsors in this effort intend to field test this technology at a site in the Elizabeth River contaminated with polycyclic aromatic hydrocarbons (PAHs) and other organic contaminants. The sponsors have invited the Elizabeth River Project to propose the site. It is recommended that the Project support this effort, including expediting testing of results, and consider co-funding a small demonstration project if test results are positive.

Discussion of Step 3:

It would be advantageous to begin sediment remediation efforts in a more controlled environment, such as a tributary creek, where results could be more readily monitored, likelihood of recontamination from adjoining waters would be reduced, and sediment remediation processes could be integrated with other desirable water and sediment quality improvements such as shoreline rehabilitation and establishment of on-shore buffer areas. The remediation efforts in such a well-defined area would be highly visible to the community and offer excellent prospects for public involvement. The sediment remediation options for this strategy are basically the same as already described, but would more likely reflect the presence of shallower water depths and narrower waterways.

A possible site would be Paradise Creek. A significant portion of the shoreline near the mouth is still relatively undeveloped and a good prospect for restoration, preferably for public use and marine habitat. The shoreline further up the creek is primarily residential. Communities and alongshore residents would be very interested in efforts to improve the water and sediment quality of the creek and possible recreational improvements. These efforts would likely increase civic pride and property values.

The extent of sediment contamination in Paradise Creek is not well known at this time due to a lack of sampling, but it is expected to be somewhat contaminated due to the proximity to contaminated landfills and known contamination nearby in the Elizabeth River. The Norfolk Naval Shipyard is located along the north shore of the creek at its mouth. The Navy is presently conducting an environmental restoration of its facilities as part of the Naval Installation Restoration Program. The Elizabeth River Project appreciates this effort and encourages the

environmental restoration of facilities along the river, especially the Norfolk Naval Shipyard. A Phase I Remedial Investigation/Risk Assessment/Feasibility Study has been conducted at the shipyard. This study documented some contamination of soils on-shore. However, there is insufficient information available to fully determine the contamination of soils alongshore and sediments offshore in Paradise Creek. The restoration of the on-shore area and off-shore in Paradise Creek should be conducted in conjunction with each other to avoid the possibility of recontamination from either site.

Discussion of Step 4:

Sediment quality guidelines are commonly used to evaluate overall ecosystem health and diversity. They provide a means of *screening potentially impacted areas* to determine when remedial action is appropriate. Without the benefit of sediment quality guidelines, decisions concerning what is and what is not contaminated become very subjective.

Sediment quality guidelines, once formulated, will allow sites to be screened readily to identify, on a consistent basis, those sediments which are truly impacting the resources of the river. Since sediments influence the environmental fate of many toxic and bioaccumulative substances, they are a link between chemical and biological processes, including those related to human health via accumulation and magnification of contaminants in the food chain.

Sediment contaminant problems present a complex challenge to both scientists and regulatory managers in the development of sediment quality guidelines designed to protect aquatic resources. There are currently *eight different approaches* to developing sediment quality guidelines. They are identified and discussed in a **background report , "Establish Sediment Quality Guidelines,"** developed during the deliberations of the Watershed Action Team and available separately.

The acceptability of adopting sediment quality guidelines will be increased by preventing them from becoming a regulatory requirement and by stressing their primary purpose of screening impacted areas on a consistent basis. Acceptability will be increased further if the point is made that funding for projects involving remediation of "contaminated" sediments will be more likely to occur if the characterization of "contaminated" is defined by an adopted guideline.

Action 2

Increase vegetated buffers, wetlands acreage and forested areas, where possible also serving these related objectives:

- increasing public access,
- reducing shoreline erosion,
- filtering run-off pollution,
- maintaining the economic productivity of the river,
- restoring habitat,
- enhancing aesthetics and quality of life.

Steps for getting there:

1997 - 2010

Step 1: Actively pursue wetlands restoration and conservation opportunities, maximizing effectiveness, acceptability and affordability by following these principles:

- ❖ Concentrate on areas where losses have been the greatest. The Southern Branch lost twice as much wetlands as any other branch from 1944 to 1977.

- ❖ To assure effectiveness, restore historical wetland areas where possible. Historical wetlands tend to retain remnants of their natural hydrology.

- ❖ Affordability can be enhanced by focusing on publicly held land where possible rather than purchasing private sites. Reserve purchase of private sites and easements to those critical areas which may be identified.

- ❖ To assure acceptability, focus on marginally developable real estate, including sites somewhat removed from the river that are not readily developable and do not involve the loss of an existing habitat or resource.

1997

Step 2: Implement the Elizabeth River Project's Wetlands Restoration Demonstration Project, designed for a one-acre site behind the Larchmont Library. Preliminary design is completed and the project has been endorsed by numerous entities including the City of Norfolk, owners of the property; the area civic league, area scientists and the library. Implementation awaits final approval of significant funding from the US EPA's Chesapeake Bay Program in Annapolis.

Step 3: Identify opportunities to assist with existing demonstration projects, including the Vegetated Buffer Demonstration Project of VA Tech and NOAA/DEQ Coastal Resources Management Program. The program is considering Watershed Action Team recommendations for sites on the Elizabeth River to begin planting as early as Spring 1996. This may become an on-going project. The Elizabeth River Project should consider recruiting, coordinating and training an on-going bank of volunteers in support of this program.

1998

Step 4: Complete an inventory, assessment and restoration priorities report in conjunction with comprehensive monitoring and data collection recommended elsewhere in the Plan. Should include identification of existing vegetated, forested and wetlands areas; potential sites for reforestation, vegetated buffer and wetlands restoration or creation, based on principles in step 1; potential river corridors and potential wetlands banks.

Step 5: Based on this inventory, develop percentage-based measurable objectives in each of the following areas: increasing wetlands, increasing forested acreage and increasing vegetated buffers. Develop and implement strategies to meet these objectives through local planning; enhanced stewardship of public and private land; and critical land and easement acquisition.

Step 6: Increase public awareness of the benefits of forested areas and increase public participation in tree planting activities. Consider an Elizabeth River Day for tree plantings. Establish five tree steward chapters per year working with the Urban Forestry Council.

2000

Step 7: Develop a strategy to promote contiguous "corridors" of habitat and large wetland areas. Capitalize on the higher effectiveness of habitat corridors and large wetlands preserves as opposed to isolated, "postage stamp" projects and piecemeal approaches. Adapt a "river corridor" program from successful efforts such as that of the Wildlife Habitat Council, which has a "river corridor" project underway on the James River in Chesterfield County. *Note:* NOAA/DEQ Coastal Resources Program sets aside $200,000 per year for land and easement acquisition grants which have not been tapped in several years.

Background action 2

Problem addressed:

The Elizabeth River's 350-mile shoreline has experienced extensive loss of wetlands and "vegetated buffers," natural areas which may mix trees, shrubs and grasses. As much as 50 percent of tidal wetlands were lost on the Elizabeth River between 1944 and 1977. Vegetated buffers provide habitat, absorb runoff, trap sediments and filter pollutants. The vegetation also stabilizes the shore, takes up potentially harmful nutrients, improves aesthetics, improves air quality and controls floods. Construction of new and restoration of historical wetlands will help reverse the trend of wetland losses in the watershed and will increase and improve the quality of available habitat.

Stressors Reduced:

Losses from filling, dredging and urban development; sedimentation, habitat fragmentation and shoreline hardening; runoff pollution, loss and fragmentation of habitat, de-forestation, toxics.

Costs:

Vary significantly with site conditions. King and Bohlen (1994) gave an average cost of developing an acre of salt marsh at $18,000 with a range of $1,000 to $43,600 excluding land costs.

Indicators for Success:

Acreage of wetlands and vegetated buffers and forested acreage restored or created can be measured and compared to existing and historical acreage. Functional assessments can also be performed to determine ecological value. Also wildlife counts, tree counts, rate of erosion, pollutant concentrations and water quality monitoring.

Discussion of wetlands restoration:

Historically, tidal wetlands within the watershed have suffered significant losses from dredging, filling and urban development. Preliminary results from mapping efforts by the VA Institute of Marine Science indicate that as much as 50 percent of tidal wetlands existing in 1944 had been lost by 1977. With the passage of the Wetlands Act in 1972, permitted losses of tidal wetlands in the watershed have been reduced to a few acres or less each year.

The technology exists to construct tidal wetlands with a high degree of certainty and reliability. Since about 1980, most major construction projects approved in the watershed have required compensatory mitigation to offset tidal wetlands losses. This policy has resulted in the construction of over 30 acres of tidal wetlands in the Elizabeth River since 1982. The vast majority of these projects has been successful at establishing wetlands vegetation. Studies have demonstrated the use of these wetlands as fish and wildlife habitat, their role as a source of primary production to support estuarine food webs and their effectiveness in water quality improvement and as sediment traps.

Discussion of vegetated buffers:

The action is to create, restore and maintain vegetated buffer areas adjacent to the shoreline (+ or - 100 feet) to address the stressors on watershed habitat and living resources. Vegetation may be chosen from four categories to meet site needs:

- Forested buffers may be considered where pines and hardwoods can be established. VA Dept. of Forestry and local government forestry staff can recommend species and assist in planting design.
- Mixed buffers involve mixtures of trees, shrubs and grasses. Good for public access if paths are maintained.
- Shrub and grass communities are primarily geared for wildlife habitat and low maintenance, as well as nutrient and sediment reduction.
- Grasses and non-woody plant communities provide public access and recreation. Can mow entire areas or mow paths and bushhog other areas occasionally to keep height down. Possible plants include grasses, wildflowers and erosion control plants such as lespedeza or switchgrass.

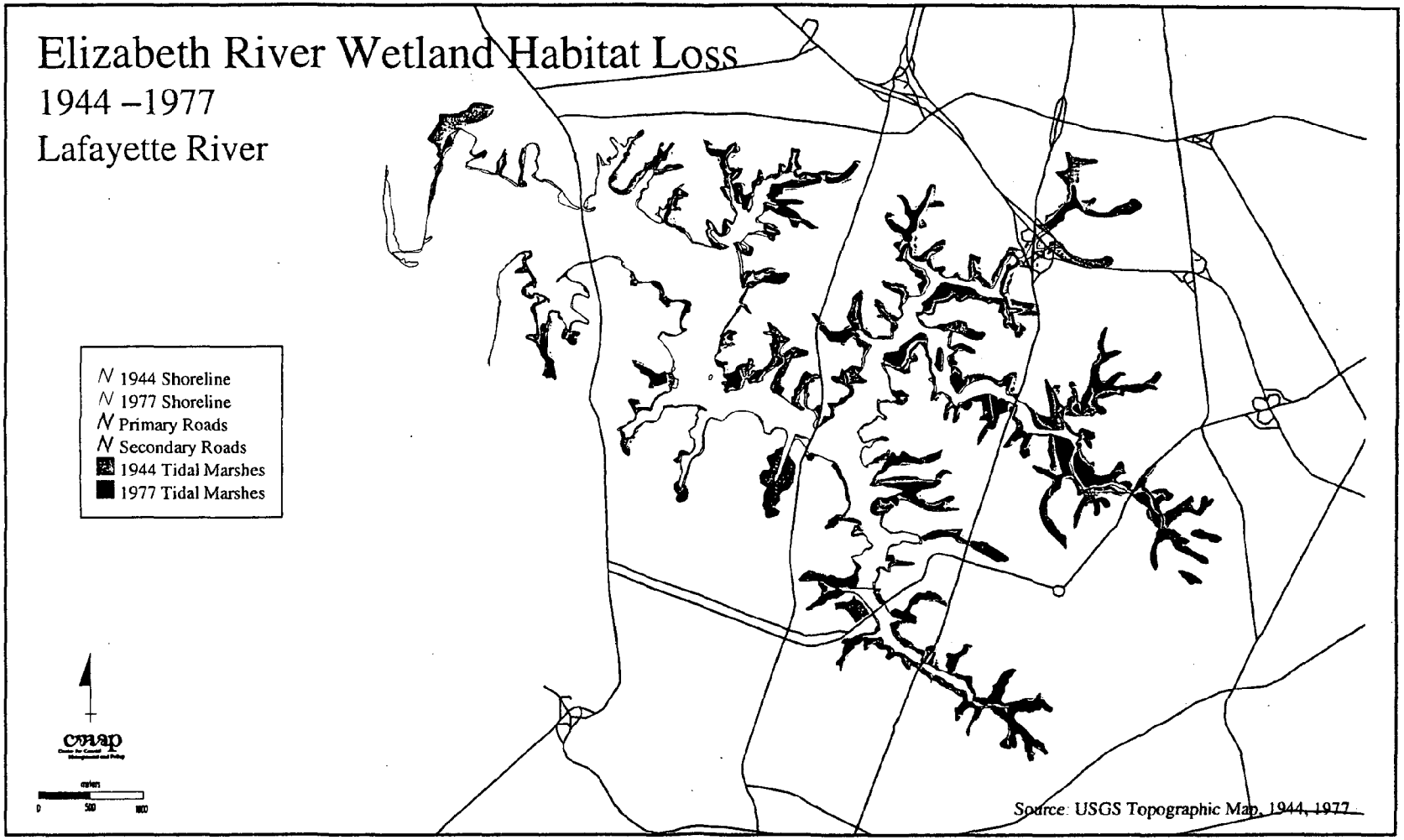
Effectiveness of vegetated buffers is well-established by research. Some questions remain such as effectiveness to reduce particular pollutants; optimum buffer width and plant mix. Additional documentation on habitat values may be needed. An existing local zoning regulatory program, Chesapeake Bay Preservation Areas, is in place to help protect buffer areas within the watershed.

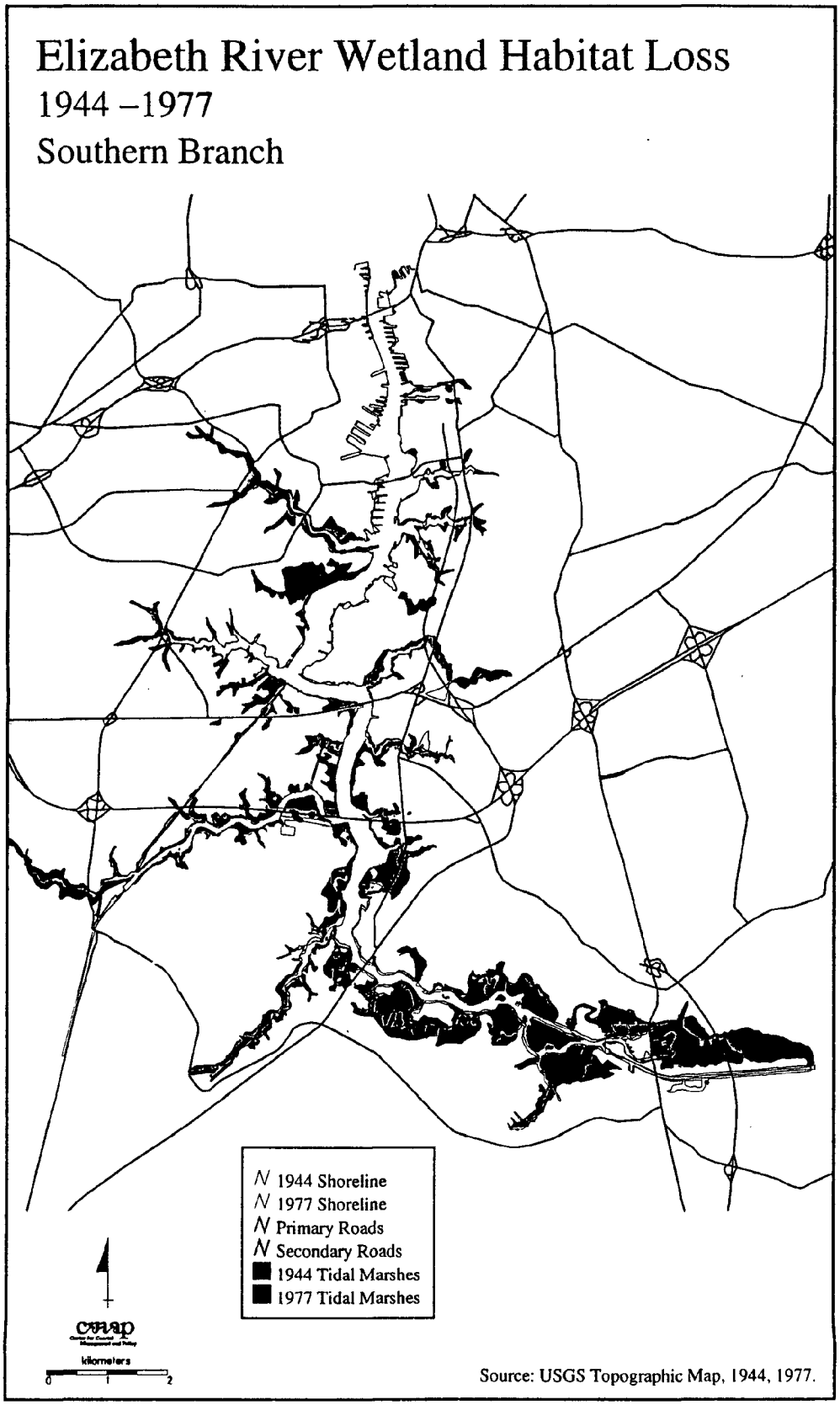
Discussion of increasing forested acreage:

Increase forested acreage in watershed through: a) Involvement of small land parcels and b) Involvement of large land holdings. Research and adapt plans from other successful watershed reforestation efforts (listed), identifying potential reforestation areas in Elizabeth River basin through a baseline inventory.

- Delaware's Inland Bays Management Plan advocates tree planting with the Department of Agriculture and Department of Forestry.
- Anacostia River restoration project has a part of its Goal No.5 to expand forest cover throughout the watershed and create a contiguous corridor of forest.
- James River Association advocates a regional greenway system to connect historic and recreational areas along the James and tributaries.

A large number of support organizations exist to provide assistance, expertise and funds for reforestation. Already contacted and pledged to help are staff members of Parks and Recreation Departments, City of Norfolk & City of Portsmouth; VA Department of Forestry and a private tree specialist in Norfolk. Organizations with potential interest include garden clubs, civic organizations, Scouts, environmental groups, students, teachers, Audubon Society, City Planning, Dept. of Agriculture, the Sierra Club's Atlantic Coast Eco-Region campaign and National Arbor Day committees.


Elizabeth River Wetland Habitat Loss
1944 –1977
Lafayette River
1944 Shoreline
1977 Shoreline
Primary Roads
Secondary Roads
1944 Tidal Marshes
1977 Tidal Marshes
cmap
0
500
1000
Source: USGS Topographic Map, 1944, 1977


Elizabeth River Wetland Habitat Loss
1944 –1977
Southern Branch
1944 Shoreline
1977 Shoreline
Primary Roads
Secondary Roads
1944 Tidal Marshes
1977 Tidal Marshes
kilometers
0
1
2
Source: USGS Topographic Map, 1944, 1977.

Action 3

Implement habitat enhancement programs at 25 percent of watershed businesses and government facilities by the year 2005, where possible simultaneously:

- ❖ increasing public access,
- ❖ increasing wetlands, forested acreage and vegetated buffers;
- ❖ reducing shoreline erosion,
- ❖ filtering run-off pollution,
- ❖ enhancing aesthetics and quality of life.

Steps for getting there:

By 1997

Step 1: Encourage business and government facilities to enhance habitat on unused, marginally developable property by providing a "how to" resource service and "green award" program. The Elizabeth River Project should develop this service in cooperation with the Wildlife Habitat Council in Silver Spring, MD, which appears successful in:

- ❖ enhancing habitat through low-cost steps such as planting small plots of seed crops or building bird houses for targeted species;
- ❖ building enthusiastic employee participation (employee Scout troops, etc., appear eager to help with plantings); and
- ❖ providing recognition certificates and other steps for achieving positive public relations.

Background action 3

Problem addressed:

The Elizabeth River watershed is about 90 percent developed, with extensive loss of fringe grasses, forested areas and other habitat. The loss of habitat was identified as one of four high risk problems in 1994 by the Elizabeth River Project's Comparative Risk Committees.

Indicators for success:

Wildlife counts, number of facilities participating, acreage of river corridors.

Stessors reduced:

Loss of habitat, habitat fragmentation.

Estimated costs:

Costs to business and government facilities is estimated to be low with ready sources of donated materials and labor for such altruistic endeavors. Costs of developing a resource service should be explored as a cooperative agreement with Wildlife Habitat Council.

Action 4

Minimize erosion along rapidly eroding shorelines by 2010, also rehabilitating existing hardened shorelines to use naturalized erosion measures wherever practical.

Steps for getting there:

1998

Step 1: Promote the use of natural shoreline features to control erosion:

- ❖ Construct non-structural shoreline rehabilitation demonstration projects promoting the economic and ecological benefits of using natural shoreline features to control erosion.

- ❖ Pursue new technologies with non-structural and structural approaches to shoreline rehabilitation.

- ❖ Elizabeth River Project should endorse reinstatement of former funding to VA Dept. of Conservation and Recreation's Shoreline Erosion and Advisory Service (SEAS) which offers no-cost site inspections to advise waterfront property owners on minimizing erosion. Funding has been reduced to minimal by the General Assembly.

- ❖ Establish a goal of total linear feet of sloped and grassed shorelines exceeding linear feet of vertical shorelines by 2010.

Step 2: Identify and address problem areas.

- ❖ Identify degraded marsh habitats and erosion prone reaches within the watershed in connection with comprehensive data collection described elsewhere in the Plan. Develop restoration strategies to restore lost wetland functions for controlling erosion, including wave energy dissipation, sediment trapping, flood buffering.

- ❖ Identify shoreline areas experiencing moderate to heavy erosion and develop shoreline rehabilitation options (non-structural or structural) to control/minimize erosion.

❖ Explore methods to reduce erosion caused by boat wakes. Explore the need for more extensivezones and for enhanced compliance with existing restrictions.

2000

Step 3: Develop and institute a successful incentive program for managing erosion-prone shorelines. Incentives to be explored include:

❖ Various combinations of grants, cost-sharing and preferential tax, loan and insurance policies closely tied to existing regulatory and advisory programs (Byrne, et al., 1979). Maryland's Shoreline Erosion Control construction fund is listed by Byrne as one example of a direct incentive approach.

❖ Enabling legislation authorizing local governments to design, construct and maintain shoreline defense structures on a shoreline reach basis, through creation of erosion abatement districts with limited bonding power (Byrne, et al., 1979). Upon establishment of local districts, the local government could issue two-way bonds for financing of the construction of suitable erosion abatement structures for the district and to assess individual property owners along the shoreline for the purpose of repaying bonds and financing maintenance costs (Established in Florida, Connecticut, Maine and Maryland).

Background action 4

Stessors Reduced:

Shoreline erosion, sedimentation and siltation.

Problem addressed:

A loss of fringe marshes and other development impacts have contributed to high erosion. Results include a loss of valuable uplands as well as ecological damage.

Costs:

Salt marsh creation has been estimated to average $18,100 per acre but can vary widely by site. Stone revetments average $55 - $65 per linear foot. Timber bulkheads average $75 - $85 per linear foot.

Indicators for Success:

Reduced upland erosion, sediment loads, water column turbidity and toxic inputs and improved habitat quality, water quality and aesthetics.

Discussion of action 4:

Benefits resulting from successful rehabilitation projects outweigh implementation costs and include eliminating the loss of valuable upland, improving water and sediment quality by reducing sediment inputs and treating stormwater runoff, providing habitat and food resources for fish and wildlife, enhanced aesthetics, and providing possible long term protection against effective sea level rise (Garbish et. al., 1994). Economic savings could be considerable as well if dredging frequencies for ship berths and navigable channels are reduced.

Shoreline rehabilitation via structural means (bulkheads, etc.) is readily accepted by the general public, however, non-structural projects, such as establishing natural shoreline features, are less frequently pursued.

Factors which might increase or decrease the affordability or acceptability of shoreline rehabilitation measures include but are not limited to size and scope of the project, potential changes in land use, existing associated facilities, current shoreline configuration, land ownership (private vs public), the presence/absence of contaminated sediments and structural vs non-structural approaches. Non-structural measures should be implemented over structural approaches whenever possible.

Discussion of non-structural approaches:

The Elizabeth River *once possessed a shallow, irregular channel floor* bordered by broad shoals, marshland and tributary creeks (Nichols & Howard-Strobel, 1991.). Dredging activities coupled with intense development of the coastal shoreline have combined to deepen the main channels and bury many former salt marshes and tidal creeks. Shoreline rehabilitation via non-structural means is recommended as an effective strategy to decrease siltation and sedimentation originating from shoreline and upland erosion.

Non-structural alternatives include re-establishing natural shoreline features such as fringing salt marshes, tidal flats and/or shallow water habitats. *This is best accomplished by grading (excavating) adjacent upland areas* to appropriate marsh or shallow water habitat elevations. Although less preferable from an environmental viewpoint, such features may also be established by select filling of subtidal areas to desired elevations. Costs associated with either strategy vary and are affected by those factors previously identified. Land ownership, for example, could significantly increase costs if upland property had to be purchased. Private land owners, however, might readily participate in demonstration projects if non-structural measures were designed which halted erosion of their respective properties.

Existing shoreline configuration will play a large role in affordability and acceptability. Excavation costs are largely determined by the quantity of material required to be removed. Further, project costs will increase if the excavated material has to be transported off-site and disposed of. Accordingly, *sites which require minimal excavation with available disposal on-site are preferred.*

Discussion of structural approaches:

In certain cases along the Elizabeth River shoreline, non-structural shoreline rehabilitation will be difficult to accomplish because of potential conflicts with current land use practices and associated facilities. This is largely true with commercial properties and less so with residential lots. In either case, a structural approach may be the only remedy to minimize shoreline erosion. Commercial properties typically have ship berthing facilities or small vessel access which may preclude establishing natural shoreline features. Accordingly, it is important that these sites maintain existing bulkheads and revetments so as to minimize siltation and sedimentation originating from erosion of their properties. Typical structural alternatives within the Elizabeth River watershed include revetments, bulkheads and marsh-toe stabilization. Revetments and bulkheads are readily accepted by residential and commercial property owners.

From an environmental viewpoint, revetments are preferred over bulkheading for several reasons. Revetments are constructed on a gentle slope within the marine environment and offer attachment sites and hiding places for estuarine organisms. Wave energy is more evenly dissipated whereas bulkheads tend to reflect this energy, increasing wave scour and erosion. The area landward of bulkheads is typically lost to the marine environment because of backfill elevations. Revetments, conversely, may be installed as low-profile marsh toe protection or as standard height structures. In either case, erosion is minimized and the revetment is routinely over-topped by normal or storm tides.

Section II: Keeping new pollution out of the river

Being good stewards

Goal: *To inspire individual responsibility and stewardship.*

"Our knowledge of the Elizabeth River ecosystem is incomplete, but some things we know... Reversing the condition of the river will be more costly and more difficult tomorrow than it is today."
The late Dr. Ray S. Birdsong,
1994 Committee Report
Elizabeth River Project

Action 5

Establish pollution prevention and/or sustainable landscaping practies among 25 percent of residential, commerical and government land users in the watershed by the year 2005, also helping achieve the related goals of:

- ❖ reducing pollutants,
- ❖ providing economic savings and
- ❖ enhancing worker and residential safety.

Steps for getting there:

1997

Step 1: Develop an Elizabeth River Project resource service and recognition program to increase pollution prevention accomplishments by owners and occupants of land in the Elizabeth River watershed. Adapt the resource service from other identified prototypes, seeking assistance from area programs including VA DEQ Office of Pollution Prevention, Hampton Roads Sanitation District and locality stormwater management divisions. Develop a resource pool of local

expertise to provide technical assistance to area businesses. Resource service should include:

- ❖ Establish a clearinghouse for information on specific pollution prevention techniques, categorized in accordance with land uses found in the watershed. Provide Internet access through existing ERP Home Page.

- ❖ Initiate a campaign to contact land owners and occupants regarding the potential for pollution prevention activities on their properties. Those who appear most likely to benefit should be contacted first. Assist interested parties in identifying techniques applicable to their land use and in planning an implementation strategy.

- ❖ Present an "award" to participating parties and provide public recognition.

- ❖ Examples of businesses to be approached might be gas stations and motor vehicle maintenance facilities.

1997

Step 2: Encourage watershed residents to adopt *sustainable landscaping* by providing a "how to" resource and education service and "green award" recognition program and by promoting increased toxics disposal opportunities. The Elizabeth River Project should pursue these efforts in cooperation with: a) the successful Bayscapes program of the Alliance for the Chesapeake Bay; b) existing assistance authorities such as Southeastern Public Service Authority (SPSA); c) developers, garden shops, hardware stores, environmental consultants, landscapers, master gardeners and others willing to pool their expertise to develop programs for mutual advantage.

The resource and education service should develop expertise and consider sponsoring workshops to promote practices including:

- ❖ use of native and other "beneficial" plants;
- ❖ integrated pest management;
- ❖ water-wise landscaping;
- ❖ turf alternatives;
- ❖ rain gardens;
- ❖ vegetated buffers;
- ❖ pervious surfaces.

Pursue: House Bill 1031, 1996 General Assembly, allows local jurisdictions to provide tax incentives for the use of pervious materials.

Step 3: As part of an integrated demonstration project also involving other actions, select a neighborhood or neighborhoods for an awareness campaign to promote sustainable landscaping, pollution prevention and increased use of "pervious" surfaces. Develop "environmental contracts" for waterfront landowners. Conduct "before," "during" and "after" surveys of awareness. Set a goal for an environmental contract signed by 50 percent of waterfront residents in the neighborhood. Provide workshops and demonstration projects, literature, volunteer water monitoring. Measurable water quality improvements, increases in native plant species, increases in pervious surfaces in demo area should then be used to help promote such activities watershed-wide.

Background action 5

Stressors reduced:

No limit; includes toxics, nutrients, depleted dissolved oxygen, pathogens and particulates.

Costs:

Pollution prevention practices that require raw material substitutions can be expensive if it requires equipment changes and the price of the new material is greater than the existing material. If the material substitution results in less toxic waste for disposal, this could offset the increased material cost. Other companies have seen savings when wastes were viewed as commodities for recycling or reuse. Cost of developing a resource service is estimated at $50,000 per year for staff and overhead.

Indicators for measuring success:

Reduction in toxics use and loadings in Elizabeth River. Number of homes, businesses and government facilities that have instituted pollution prevention measures.

Discussion of pollution prevention service:

A pollution prevention plan is one of the most effective means currently available to industry to reduce toxic substances entering the environment. Pollution prevention provides for the potential removal of every hazardous substance entering the Elizabeth River. It also has been well-documented that pollution prevention is a "win-win" situation for companies that incorporate it into their operations. Surveys show that, once companies have designed pollution prevention plans, high percentages of those companies voluntarily implement the plans because the benefits to the company have become obvious.

The potential effectiveness of this option is substantial. The 1993 Toxics Release and 1,167,580 pounds of reported chemicals are being discharged into the air annually. Those chemicals pose a potential threat to the river and to public health. This risk is compounded by the danger of spills and accidents during the transportation of toxic substances.

This action consists of a three-part program. First, *a clearinghouse for information* on specific pollution prevention techniques should be developed and categorized in accordance with the land uses found in the Watershed. The information could be collected in several ways. A bibliography of sources of interested parties should be developed and maintained. Hard copies of documents and other information could be collected in a library for the use of interested parties. The information should be collected into a home page on the Internet (ERP has a home page in existence) for access by those landowners with computer capabilities. Such information can then be easily accessed by any individual wishing to consider pollution prevention for their operations.

Examples of information that should be incorporated into the database include: federal, state and local laws requiring some form of pollution prevention; results of prior planning efforts

and analyses in the Elizabeth River estuary; industry-specific pollution prevention plans prepared by the EPA, the VA DEQ, and other state or federal agencies; pollution prevention information developed by trade associations such as the Chemical Manufacturers' Association; names of organizations that will provide guidance to parties wishing to implement pollution prevention on their property.

Next, a campaign will be initiated to contact all owners and occupants of land in the Watershed regarding the potential for pollution prevention activities on their properties. This is the step that is critical to the success of this option. A single person should be identified to serve as the coordinator of the process of providing guidance to interested landowners and occupants. A list of activities located in the Watershed should be developed and evaluated. Those who appear to be able to benefit most from this guidance should be contacted first.

Third, parties that participate will receive an award for implementing pollution prevention techniques with positive results, possibly with different levels as an individual's pollution prevention efforts increase. The recognition should include advertisement of the successful parties in a public forum.

One employee with minimal computer skills and an understanding of the environmental field should be identified to coordinate this option. The person should have some technical experience and understand the environmental regulatory framework in Virginia. The person should also have good interpersonal skills to enable them to serve as the representative for pollution prevention with the landowners.

It is recommended that the program be established with this employee serving the ERP directly. As the program develops, consideration should be given to cooperation with organizations such as the Hampton Roads Chamber of Commerce, the Hampton Roads Sanitation District, the Hampton Roads Planning Commission, the DEQ and the Chesapeake Bay Foundation. These organizations would already be involved in the program, as they are involved in pollution prevention planning and guidance already and their resources and assistance will be tapped in conducting the project in the Elizabeth River watershed.

Discussion of sustainable landscaping:

"Americans manage 30 million acres of lawn in the U.S. and according to the EPA they use approximately 100 million tons of fertilizer and more than 80 million pounds of pesticides each year ... Residents use 10 times the rate per acre of pesticides used by farmers ..."
- Alliance for the Chesapeake Bay.

This action promotes alternative landscaping to reduce runoff pollution through methods including:

- Use of *native plant species*, well-adapted to the local climate and soil, reduces the need for fertilizing, applying pesticides and watering. Available guidance resource: "Using Beneficial Plants," Alliance for the Chesapeake Bay.
- Use of *integrated pest management* strategies reduces the need for pesticides. Guidance resource: "Integrated Pest Management," Alliance for the Chesapeake Bay."
- Xeriscaping conserves water through *water-wise landscaping* and zonal planting design. Guidance resource: "Bayscaping to Conserve Water," Alliance for the Chesapeake Bay.
- *Turf alternatives* require less fertilizer, watering and other treatment than the traditional lawn.
- *Rain gardens* are a new concept for alternative stormwater management, combining grasses, shrubs and trees to simulate a forest environment at the low point of a developed lot. A Maryland developer is piloting the use of "rain gardens" in an 80 acre development in Prince George's County. Each rain garden is 300-400 square feet and designed to require no fertilizers or pesticides. "The settling of sediments into shallow

pool areas, the natural processes of plants and microbes, and chemical reactions occurring in the soil allow the gardens to absorb and purify stormwater runoff. Rain gardens restore the functions of wooded wetlands removed by land development.

- "Pervious surfaces" allow rain to seep through, decreasing the amount of contaminated stormwater running off of "impervious surfaces" and into rivers and bays. Rain water, if allowed to percolate through the natural soils, will cleanse itself as it returns to the aquifer. Pervious surfaces also moderate river water temperatures.

Discussion of neighborhood campaign:

This step begins with preparing a comprehensive communication plan targeted at a variety of audiences in a well defined area along the Elizabeth River (including awareness surveys at three stages, before, during and after program implementation). The education campaign should be an integral process to reinforce the benefits of sustainable landscaping, trying a new product (pervious surface) and reducing polluting behaviors. The campaign would include neighborhood or single family environmental audits, publications, yard signs, presentations, exhibits, media relations, videos and signage. To be effective, the educational campaign must involve more than literature aimed to inform; it should involve extensive personal contact and building mutually beneficial relationships among affected parties.

Next a workshop should be organized to educate residents and locate receptive property owners, neighborhoods and influential leaders who will participate in smaller demonstration projects to build sustainable landscaping and pervious surfaces. Introduce native plant species with the assistance of Master Gardeners, university biology classes and local landscaping companies. Include integrated pest management and water wise strategies as well as turf alternatives and rain gardens.

Third, negotiate with all parties involved to contract landscaping and pervious surface companies and locate a funding source. Increase pervious surface on any new public parking lots and roads developed in the selected area; this will require approval of the locality, the community and possibly other agencies. Where possible, install smaller roads & parking lots; use pervious materials (asphalt, concrete, interlocking pavers, plastic grids) and fold these into construction plan approval & inspections by the city. Design a pilot project on an entire neighborhood street with a discernible outfall to facilitate water monitoring. Include neighborhood cleanups to remove litter in waterways.

Additionally, a volunteer monitoring campaign will be needed to measure water quality.

Action 6

Reduce pollution from stormwater runoff to the maximum practical extent, achieving this in part through related actions to increase vegetated and wetlands areas, decrease impervious surfaces, and increase pollution prevention achievements.

Steps for getting there:

1996 - 2010

Step 1: Establish on-going Elizabeth River Project working relationships with the cities of Norfolk, Portsmouth, Chesapeake and Virginia Beach in order to provide the public support and the public-private resources and partnerships needed to achieve the following objectives:

- ❖ Increase public acceptability of city stormwater pollution reduction programs and for the active use of city resources to implement pollution management.

- ❖ Achieve full, effective implementation of the extensive stormwater pollution controls already in place or proposed by the cities, with recognition that intended improvements are likely to remain only partially realized without greater public awareness and support. In particular, promote full implementation of city permits for stormwater management.

- ❖ Promote regional adoption of innovative, cost-effective stormwater pollution control techniques to retrofit outmoded stormwater systems in devloped areas. As public support increases, work in cooperation with the cities to consider ambitious measurable objectives for replacing significant amounts of outmoded city stormwater systems by 2010. Actively pursue opportunities to assist through:
  - ~ research of promising, cost-effective retrofit techniques specific to the Elizabeth River, including exploring costs and effectiveness of retrofitting the watershed's extensive network of ditches (now used to drain sites and control flooding);
  - ~ identification of potential sites for demonstrating promising retrofit techniques, including exploring the potential for retrofits at highly urbanized existing lakes (see Portsmouth chart);
  - ~ exploration and development of broad-based, public and private funding for such techniques, including exploring grants and donated private assistance.

- ❖ Promote adoption of uniform standards for implementation of Best Management Practices for new development and re-development within the watershed.

❖ Promote regional land use planning and practices within the watershed to reduce the development of impervious areas. Such land use planning may involve increasing pedestrian and bikeway access to activity centers, zoning amendments to allow centralized community services, shared parking for compatible businesses, cluster developments, and alternative surfaces for overflow parking areas.

Step 2: Promote the development of a voluntary program providing incentives for industrial and commercial facilities to capture and treat the first flush of their stormwater (originally a separate action). VA DEQ and area businesses are key implementation players. Recognizing that the first flush often contains the highest level of pollutants, objectives include:

❖ Developing incentives, such as matching private or public funds and public recognition, for engineering and construction of techniques to capture the first flush. Engineering solutions would also provide the means for this water to be treated and discharged.

❖ Focusing assistance efforts on industrial and commercial facilities whose stormwater runs directly into the river with little opportunity for soil infiltration.

Step 3: Explore the effectiveness of more frequent street-sweeping by municipalities. Street-sweeping removes contaminated soil and debris before it can be washed into the river.

Background action 6

Problem addressed:

As much as 90 percent of new pollution entering the Elizabeth River today arrives in runoff from parking lots, lawns and other industrial and residential surfaces. An aging system of stormwater drains rushes a toxic soup of oils, fertilizers, pesticides and metals directly into the river.

Discussion of step 1:

Stormwater runoff contributes 88 percent of the metal, and 99 percent of the polycyclic aromatic hydrocarbon loadings to the river (URS 1995). Meanwhile, the greatest land use in the Elizabeth River watershed is single-family residential. This use has 25 percent imperviousness, referring to the amount of hard surface unable to absorb runoff. Industrial areas, concentrated along the riverbank, are typically 75 percent impervious. Impervious surfaces accumulate pollutants from incomplete combustion of fossil fuels, metal alloy corrosion, automobiles, pesticide use, industrial manufacturing and atmospheric deposition. During storms these accumulated pollutants are washed into the intricate system of storm drains that discharge into the Elizabeth River. Residential areas in the watershed are often intensely managed with inputs of water,

fertilizer and pesticides. Contaminants from lawns, golf courses and managed landscapes also make their way into the river.

Reducing and managing non-point source pollution is *the biggest challenge to reducing new pollutants into the Elizabeth River.* Stormwater management is essential to addressing non-point source pollution in conjunction with pollution prevention.

Stormwater management to control the quantity and quality of stormwater runoff is achieved through *best management practices* (BMPs). BMPs are structural and nonstructural measures to reduce the pollutants available for transport by rainfall, or reduce the amount of pollutants in the runoff before it is discharged to a surface water body. Effective BMPs include pond systems, wetland systems, infiltrations systems and filtering systems. Table 1 compares features of some BMP options. BMPs are currently required for new development and redevelopment in Chesapeake Bay Preservation areas (Virginia Beach requires BMPs for all new development). However, the majority of the watershed was developed prior to the Chesapeake Bay Preservation Act, and stormwater enters the waterways untreated. BMP "retrofits" are structures or a series of structures designed to mitigate the detrimental affect of human activity from development in an urban watershed. Retrofits are designed to remediate the affect of altered hydrology, reduce pollutants to receiving waters, and enhance aquatic habitat.

The cities of Chesapeake, Portsmouth, Virginia Beach and Norfolk have stormwater management programs as part of their Virginia Pollution Discharge Elimination System (VPDES) municipal permit applications. The four primary municipal stormwater pollutant sources are: *runoff from commercial and residential areas; illicit discharges and improper disposal to the storm sewer system; runoff from waste disposal and industrial facilities; and runoff from construction sites.* The VPDES program requires that municipalities implement a stormwater management program to control runoff from construction sites, detect and eliminate illicit discharges, prevent improper disposal into storm drain systems, and identify structural control measures. Permits applications have been submitted, and permits are scheduled for issue early this year. Each city has a different program, and they are at different stages of implementation. Funding of stormwater programs (Chesapeake Bay Preservation Act, Sediment & Erosion Control, Virginia Pollutant Discharge Elimination System) is the responsibility of municipal government, and day-to-day implementation falls on municipal staff. The Hampton Roads Planning District Commission provides technical support to localities for stormwater programs and coordinates regional activities.

One of the major obstacles to non-point source pollution prevention and stormwater management is a general misunderstanding of the problem. Most of the public is not aware that 90 percent of water pollution is from non-point sources. A negative attitude towards environmental issues is prevalent among some sectors of the community. Some vocal business community groups object to the stormwater fee and costs of compliance with environmental regulations. Due to competing demands, funding and support are not appropriated by decisionmakers to retrofit stormwater controls in previously developed areas. Funds raised through the stormwater fee are currently being used for flood control projects, street cleaning, other activities that the cities always conducted from the general fund. The public assumes that because they are paying for stormwater management, the problem is being addressed. Without a good understanding of non-point source pollution and the methods to control it, there has been little pressure on decisionmakers to address the problem.

(For a full discussion of this action, see the discussion paper, Non-Point Source Pollution Management Option, available separately).

Discussion of need for urban retrofits:

Traditional stormwater programs primarily address new development. *There is a great need to retrofit stormwater systems in developed areas.* Residential and commercial sources of runoff should be targets for demonstration projects. The Hampton Roads Planning District Commission is preparing a guidance document for BMP retrofit siting as part of the regions tributary strategy project to reduce nutrients in the Chesapeake Bay.

Discussion of need for ditch retrofits:

The region has an extensive network of ditches designed to drain sites and control flooding. The concept of improving the water quality function of ditches needs to be explored. An infiltration trench beneath a ditch would permit water to be processed through the soil and recharge the groundwater. Following is a list of potential retrofit sites:

- **BMP construction at upstream end of road culverts**
- **BMP construction at storm drainage pipe outfalls,**
- **Small instream practices in open channels**
- **BMP measures at the edges of large parking areas.**
- **BMP construction within highway rights-of-way.**

Discussion of the potential for lake retrofits:

Opportunities exist to improve the water quality function of existing lakes in the watershed through retrofitting and maintenance. The drainage area to the Eastern Branch of the Elizabeth River within Virginia Beach is 8,834 acres. The existing land use is highly urbanized throughout most of the drainage area, and therefore only a small percentage of the total area is available for future development. A pilot project on a lake that includes retrofits, pollution prevention measures, and other management options may improve the potential of bringing about measurable improvement within five years. Retrofitting existing ponds cost $200,000 to $500,000 for small structures, and $2 million to $3 million for large lakes. Norfolk plans to dredge and enhance a one-acre pond at an estimated cost of $200,000. This project is a priority because the condition of the pond is considered a public nuisance. The residents have demanded that the city restore the pond for aesthetic reasons.

Discussion of step 2:

The purpose of this action is to provide site engineering and construction of holding vessels or lagoons designed to *capture the first flush* of stormwater; also to provide means by which the water may be treated and discharged. Industrial process and stormwater discharges are minor point source stressors in the Elizabeth River Watershed, contributing to 7.4% of the total suspended solids load and 6.9% of the biological oxygen demand. However, these facilities contribute significantly to solids and oil and grease loads and the reductions made on a site by site basis with affordable engineered systems would contribute to a cleaner Elizabeth River.

The first flush of storm water, defined as the volume of runoff discharged in the time required for runoff to flow from the most remote section of the site to the discharge point during a precipitation event, typically contains a higher load of contaminants than later discharges from the same rainfall. The major accumulation areas of conventional and toxic pollutants in industrial settings are: parking lots, loading docks, and building roof tops. These areas generally collect sediment, metals, oils, grease, surface spill residuals, and on-site and off-site stack emission particulates in between rainfall events.

Efforts should focus on facilities whose stormwater runs directly into the river with little opportunity for soil infiltration. We suggest that matching private or public funds be provided for engineering/implementation on a site by site basis. Targeting of facilities would be made

through stormwater records kept by the VA DEQ. After contacting the industrial/commercial entities with significant identified stormwater discharges, coalitions of businesses could be formed working together toward this goal. Incentives for businesses include public attention for good stewardship and corporate responsibility.

Based on the research of the potential effectiveness of first flush stormwater capture/ treatment we conclude that this option in selective cases holds promise for conventional pollutant reductions. However, we note that not all industry could economically comply with this measure for several reasons including size of facility, inability to economically route and capture stormwater, lack of space for vessels or retention pond(s). However, many smaller industries, especially those with parking lots, stock yard areas, or other significant open air work areas can provide first flush capture/treatment for a relatively low cost.

Maximum effectiveness, affordability and acceptability of this option is dependent upon the involvement of industry to seek its own solutions, given what makes sense for each property. It also requires environmental groups that are willing to provide funding for recommended control measures demonstrating the desire to work with industry towards this goal. And lastly, it requires regulatory agencies that reinforce voluntary measures to improve environmental controls, by creatively overcoming regulatory hurdles to this progress.

(A fuller discussion of "first flush" treatment is available separately in the report "Preliminary Feasibility Study of Stormwater Discharge Pretreatment from Industrial Facilities on the Elizabeth River.")

Cost Estimates [1]	
BMP Improvements	
Marsh establishment	$100,000-$200,000
Lake enhancements	$100,000-$300,000
Disposal fee for 23,000 tons of dredged material to enlarge lake @$41/ton	$929,880
BMP Structural improvements	$50,000-$100,000
Sand filter	$50,000
BMP Maintenance	
Cleaning	$1,000
Repair pipes, inlets, or outlets	$1,000 - $6,000
Remove vegetation	$2,500
Erosion control/w riprap	$3,500
Erosion control/w matting	$2,000

[1] Norfolk Stormwater Management Plan

Table 4-7
EXISTING PORTSMOUTH LAKES

Name	Location	Owner	Surface Area (acres)
Lake Armistead	Armistead Forest	Individual lot owners and Quadrangle Assoc.	0.6
Rivershore Road Borrow Pit	North Churchland	Rdovit Corp	9.5
Lake Sweetbriar	Sweetbriar	Individual lot owners	4.0
Horseshoe Lake	Sterling Point	Single ownership, owner unknown	5.8
Lake Jean	Sterling Point	George T. McLean (as per original subdivision plat), at present uncertain	9.8
Lake Collins	Collinswood	Howard and Patricia Hudson	2.9
Longpoint Lake	Longpoint Subdivision	Individual lot owners; most recent lake in the City	4.7
Lake Willis	Sweetbriar	Individual lot owners	0.9
Lake Pam	North Park Manor	Individual lot owners	0.8
Misc. Lake	Sterling Point, Verne & Garner Avenue	Individual lot owners	0.3
Lake Kingman	West Norfolk	Individual property owners	20.3 (tidal)
Lake Cavalier	Cavalier Manor	Bold Corp. and some individual lot owners	78.2
Green Lake	Cedar Point	Individual lot owners	29.5
Peachtree Lake	Peachtree neighborhood, on common land as part of PUD	Responsibility of homeowner's association	2.0

Action 7

Identify and correct inadequate sanitary collection systems, for the purpose of reducing human health risks and ecological risks from fecal coliform bacteria in the Elizabeth River.

Steps for getting there:

1996 - 2000

Step 1: Include boaters and marinas in a diverse task force possibly sponsored by the Virginia Department of Health to develop an effective program for increasing the use of sewage pump-out facilities by recreational boaters. Recommendations of the task force should take into account:

- ❖ Examination of other successful programs including: "Pump, Don't Dump" program of the State of Maryland; and 1994 VA Department of Health program providing no-charge, shore-based, portable pump-out facilities for boaters on the Lynnhaven River.

- ❖ Sound data on the extent and nature of the problem, including further attempts to identify and quantify the major sources of fecal coliform bacteria in the Elizabeth River.

Recommendations should include the following program components:

- ❖ Effective strategies for reducing sewage dumped by recreational boaters;

- ❖ Education and incentive components and identification of feasible funding sources;

- ❖ Preliminary identification of other major sources of fecal coliform bacteria (such as inadequate septic tanks) in the Elizabeth River and .

Step 2: Further identify the major sources of sewage discharges and develop initiatives to address them.

Step 3: Build public support for the municipalities in their development of strategies and incentives for home and business owners to repair leaks in "lateral" sewage lines, or the lines running from a house or business to the curb. These lines are generally the responsibility of the property owner and, as such, pose a missing link in efforts to maintain adequate human sewage collection.

Background action 7

Problem addressed:

Unsanitary conditions related to human and animal sewage have been a significant problem in the Elizabeth River since early in the century. The Department of Health, Division of Shellfish Sanitation has condemned shellfish beds in the Elizabeth River for decades based on sanitary surveys. Fecal coliform counts, the typical method for determining the presence of fecal matter, are one indicator used by the Health Department to identify stressed shellfish beds.

Stressors reduced:

Fecal coliform, BOD, nutrients, toxics, organics, oil and grease, heavy metals.

Indicators for success:

Fecal coliform counts.

Costs:

A portable pump-out program on the Lynnhaven River cost about $45,000. Repair of sewer lines averages $100 per linear foot.

Discussion of increased use of pump-out facilities:

The VA Dept. of Health requires that all marinas with three or more slips have on-shore toilets, sewage dump stations, and pump-out facilities. Exceptions can be granted for a "cooperative" where one marina is the source of pump out facilities for the entire group. All new marinas must have a certificate from the health department for a pump out facility plan before a permit for construction will be granted by the VA Marine Resources Commission. Backfitting marinas with these facilities pose a different problem. Compliance with the on-shore toilet requirement is excellent. However, compliance decreases with sewage dump stations to approximately 50-50 for pump out facilities. The cost of installation of these facilities belongs to the marina owner, who tries to recoup with fees for use of the facilities. Some relief in the form of low-cost loans may be available from the US Fish and Wildlife Service through the Clean Vessel Act. This program is funded through taxes on fishing equipment and gas.

The Elizabeth River is one of several major waterways in Hampton Roads used significantly by the region's nearly 25,000 registered recreational boats. The Elizabeth River is an integral part of the Atlantic Intracoastal Waterway. During a five-month period in 1993, 5,358 yachts and 2,614 small boats traveled through the locks at Great Bridge and Deep Creek.

A boater education campaign is needed in cooperation with the health department and others. In addition, funding and feasibility should be explored for more direct programs such as a portable pump out facility. In 1994, the health department used a grant from the Near Coastal Water Fund to establish a shore-based portable pump out facility on the Lynnhaven River. Old Dominion University environmental health students ran the operation. According to the health department, the program was very popular. The cost for subsequent use of the equipment would be less as start-up costs are already paid.

Discussion of step 2:

Sewage from recreational boating is only one source of sewage discharge and high fecal coliform counts in the river. Efforts should be made to identify the major sources. Once these are known, programs should be adopted to address them.

Discussion of step 3:

Maintenance of the sanitary sewer system can be divided into several categories depending upon who is responsible for the upkeep. Home owners, large industries such as the Navy, and business owners are responsible for the system until it ties into the part of the system controlled by the municipality. The individual municipality maintains the lines until they connect with the lines maintained by the sewer authority. According to the HRSD, over $60M has been spent over the last 10 years by the eleven municipalities in the Tidewater area on their sewer lines. HRSD alone has spent $19M during that time to effect repairs and upgrades to their sewer lines. URS Consultants report that of the $9M dollars spent by the City of Norfolk in 1991 on sewer line rehabilitation 13.6 percent ($1.2M) was spent on 11 projects upgrading private laterals. This is a new program whereby the City of Norfolk is upgrading private laterals which are in the public right of way. The four municipalities in the watershed have had active programs to include renewal of lines, slip lining, in situ repairs since the 1980s.

According to URS Consultants, the input from private systems including business and home laterals can be greater than from the publicly owned collection systems. A typical 1,500 square foot house may contribute 100 gallons per day inflow during a normal year of 40 inches of rainfall. Disconnection of downspouts, yard drains and foundation drains are some of the techniques that can be used to reduce inflow.

Waterbody	Shellfish Condemnations	Swimmable Goals Supported?	Fishable Goals Supported?	Water Quality
1	Entire	Fully	Nonsupported	Limited
2	Entire	Fully	Nonsupported	Limited
3	N/A	Fully	Fully	N/A
4	Entire	Fully 73% Nonsupported 27%	Nonsupported	Limited
5	Entire	Fully	Nonsupported	Limited
6	Entire	Fully	Nonsupported	Limited
7	Entire	Fully	Nonsupported	Limited
8	Entire	Fully	Nonsupported	Limited
9	N/A	Partial	Partial	Limited
10	Entire	Fully	Partial	Limited

Table 1 COMPARISON OF THE WATERBODIES WITHIN THE ELIZABETH RIVER WATERSHED

Key: This table compares ten waterbodies of the Elizabeth River described below. The second column identifies the extent of shellfish condemnations within the watrebody. If the entire waterbody is identified as a shellfish condemnation area, the Virginia Department of Health (VDH) prohibits any person, firm, or corporation from aking shellfish in this area for any reason.

1 - Southern Branch of the Elizabeth River - Great Bridge Waterbody - 1.19 square miles (762) acres) extend from the Army Corps of Engineers' locks near Oak Grove to the confluence of Jones and Paradise Creeks including the upper reaches of the Southern Branch mainstem, Deep Creek, Mains Creek and New Mill Creek.

2 - Southern Branch Elizabeth River - Naval Shipyard Waterbody - .067 square mile (429 acres) extend from Jones and Paradise Creeks to the Downtown Tunnel (Interstate 264) including Jones, Paradise, Scuffleton, St. Julian and Gilligan Creeks.

3 - Lake Taylor Waterbody - located north of the Elizabeth River's Eastern Branch including the lake's watershed to the dam at the headwaters of broad creek.

4 - Eastern Branch Elizabeth River Waterbody - 1.84 square miles (1,178 acres) begin in western Virginia Beach and continues westward to its confluence with the Elizabeth River mainstem and Southern Branch including Kings Creek, Broad Creek, Indian River, Mosley Creek, Steamboat Creek and Pescara Creek.

5 - Elizabeth River - Berkley Waterbody - 0.25 square miles (160 acres) extend from Inerstate 264 crossing downstream to the point where the southern and eastern Branches converge in the mainstem Elizabeth River and continuing eastward into the Eastern Branch upstream tot he Berkley Bridge (Route 460) crossing.

6 - Western Branch Elizabeth River Waterbody - 1.17 square miles (1,094 acres) begin at Pinner and Lovett's Points on the mainstem of the Elizabeth River and extend in a southwesterly direction to its headwaters in Portsmouth including Lilly Creek, Hull Creek, Baines Creek, Sterns Creek, Drum Point Creek, Bailey Creek and Goose Creek.

7 - Elizabeth River - Lambert's Point Waterbody - 2.82 square miles (1,804 acres) encompassing the mainstem and tributaries from the divergence of the Eastern and Southern Branches to an imaginary line drawn from the northeast corner of Craney Island Fuel Depot to Pier 6 at Lambert's Point including Craney Island Creek, Smith Creek and Scott Creek.

8 - Lafayette River Waterbody - 2.44 square miles (1,562 acres) encompassing the mainstem and tributaries from its headwaters to its confluence with the Elizabeth River including Knitting Mill Creek and Wayne Creek.

9 - Masons Creek Waterbody - 0.47 square miles (301 acres) on the southern shore of the Willoughby Bay including the mainstem and tributaries from its headwaters to the confluence with Willoughby Bay.

10 - Elizabeth River - Craney Island Waterbody - 11.07 square miles (7,085 acres) encompassing an area from an imaginary line drawn from the northeast corner of Craney Island to Pier 6 at Lambert's Point and to the confluence with Hampton Roads including the Elizabeth River mainstem, Willoughby Bay and that portion of Hampton Roads Harbor adjacent to the Norfolk Naval Base.

Action 8

Reduce TBT to non-toxic levels in the Elizabeth River waters and sediment, while enhancing the opportunity for continued competiveness of Virginia's shipping, shipbuilding and other businesses.

Steps for getting there:

1996 - 1997

Step 1: Initiate aggressive action seeking the establishment of a national ban on the use of TBT on paints and all water-going vessels.

Step 2: Support the establishment of an international ban on the use of TBT paints on all water-going vessels.

Step 3: Maintain Virginia's progress toward reducing the sources of TBT by continuing current TBT regulations.

Step 4: Continue to conduct further study of the nature of the TBT problem at the local level, provided funding for such studies is found. Further study could provide better understanding, for instance, of the actual levels of release from the shipyards and newly painted hulls during painting events and subsequent effects on ambient levels.

Background action 8

Problem addressed:

Tributyltin (TBT) is a pesticide used in antifoulant paints to protect boat hulls from barnacles and algae. TBT compounds are highly toxic to aquatic life and are capable of causing adverse biological effects at extremely low levels.

Stressors reduced:

TBT.

Indicators for success:

Levels of TBT toxic impacts in the Elizabeth River.

Costs:

In a recent proposal developed by the Virginia Institute of Marine Science in conjunction with the Department of Environmental Quality to collect necessary baseline information concerning TBT in the water column and to monitor the effect of a single ship-painting event on aqueous TBT concentrations, the estimated study cost was $70,000 to $100,000.

Discussion of TBT action

Virginia has taken the lead in reducing sources of TBT. The Watershed Action Team supports this progress. The need now is to actively promote national and international bans on TBT in order to provide a fair playing field for Virginia ship repair facilities as they compete with markets outside Virginia.

Available monitoring data show that water column concentrations of TBT in the Elizabeth River are generally low compared to marina areas and average in the 10-20 ng/L range. Mean concentrations are generally highest near the confluence of the southern and eastern branches of the river. Concentrations throughout the Elizabeth River, while small compared to those observed near marinas, exceed the Virginia standard for TBT.

The Elizabeth River estuary has seen little decline in TBT concentration since the imposition of the partial ban required by the Organotin Antifouling Paint Control Act of 1988. This is in stark contrast to the situation near many marinas where there has been a clear decline in TBT concentrations since the ban (Huggett, 1992). The major source of TBT near marinas is believed to have been TBT-containing paints on small hulls and uncontrolled application whereas different sources dominate in the Elizabeth River.

TBT in the water column of the Elizabeth River may originate from multiple sources:

- leachate from merchant and cruise ships entering the river,
- outfall from shipyards which strip hulls and apply TBT-containing paint under regulatory requirements for BMP,
- desorption from contaminated sediments and paint chips,
- or, in rare cases, input from other industrial sources.

Occasionally very elevated TBT concentrations have been measured locally in the Elizabeth River. These events are believed to reflect localized transient TBT inputs perhaps resulting from ship-painting events or the passage of a TBT-coated ship. Monitoring of TBT inputs in New York Harbor have shown very high TBT concentrations (μg/L concentrations) in the vicinity of drydocks during ship maintenance and painting and near newly-painted ships as they leave the drydock (Unger 1993). Monitoring studies in the Elizabeth River have not been designed to identify and quantify inputs in this way, leading to substantial uncertainty about the source of TBT during the observed events.

Action 9

Promote mass transit and alternate transportation, based on a recognition of automotive usage as a major source of pollution in the Elizabeth River.

Steps for getting there:

Step 1: Form a mass transit and alternate transportation team of the Elizabeth River Project to pursue the following objectives:

- ❖ Identify ways to increase support for and effectiveness of established organizations already actively promoting mass transit and alternate transportation;

- ❖ Alert Elizabeth River Project members and leadership of opportunities to provide needed support for specific initiatives, and

assist them in responding to these opportunities in a timely and informed manner;

❖ Promote public understanding of the link between use of cars and trucks and water quality degradation in the Elizabeth River. Explore forming a speakers bureau for this topic;

❖ Explore whether any direct initiatives, such as a biking and walking path, are within the scope of the Elizabeth River Project to implement.

Background action 9

Problem addressed:

Cars and trucks are a major source of pollution in the Elizabeth River through air emissions and through metals and oils washed off the roads with the rain. A recent EPA study indicated that air emissions are the greatest single source of cadmium, chromium, copper, lead and mercury in the Chesapeake Bay (VA Pilot, April 26, 1994). In the **Santa Clara Valley Non-Point Source Control Program** (Woodward Clyde Consultants, 1992), automobiles were found to be the leading source of metals of concern (cadmium, lead, mercury, and zinc) in the Lower San Francisco Bay.

Stessors reduced:

Zinc, copper, cadmium, chromium, iron, oil and grease and air emissions causing acid rain.

Indicators for success:

Increases in funding and ridership of mass transit; decrease in short trips by automobiles.

Discussion of mass transit

The Norfolk Virginia Beach Corridor Major Investment Study (TRT, on-going) indicates that traffic volumes on Route 44 and I-64 are expected to increase by 87-95% by the year 2015 if we do nothing. Since the "do nothing" alternative will jeopardize Hampton Roads Air Quality Attainment Standard, and because it is difficult to continue to widen roads that have already reached their limit, light rail and alternate transportation alternatives are being studied to avoid the consequences of non-attainment.

Additional reductions of oil and grease will also be realized. Also, a reduction of impervious areas will help to reduce the conveyance of these pollutants to the river. Light rail and alternate transportation also improve the quality of life in the community. Benefits of regular exercise have been extensively documented. Light rail will provide additional access to many Hampton Roads residents, will improve air quality, and will reduce traffic congestion.

The question is: Will it work? Two cities with highly successful light rail systems are St. Louis, Missouri and San Diego, CA. Both experienced an economic boon in their downtown centers as a result of the light rail system. In the first year of operation in St. Louis, 30,000-40,000 passengers per day rode the light rail. This was three times more than forecasted. For 80% of the riders, this was their first time they ever commuted by rail. And ridership on the bus system increased during the same period.

The key to successful implementation of this option is to link automobile and truck usage to water quality degradation. The link between automobile usage and air quality is well known and generally accepted by the public. However, the link between automobile and truck usage and water quality is not well known, though its significance is just as great. **(Further development of this action is provided in the discussion paper on mass transit and alternate transportation, available separately).**

Action 10

Enhance compliance with existing regulations.

Steps for getting there:

1996 - 2010

Step 1: Support adequate staffing and other resources needed to implement existing regulations in a manner effective for reducing toxics and other pollutants in the Elizabeth River. Regulations identified as important to achieving these ends include but are not limited to:

- ❖ Chesapeake Bay Preservation Act;
- ❖ Erosion and Sediment Control Regulations;
- ❖ VA Pollutant Discharge Regulations.

Step 2: The Elizabeth River Project should explore interest and support among business, citizen and government concerns for a "blue ribbon panel" of those interests to develop a more comprehensive approach to enhancing regulatory compliance at the local level. The panel might address issues including:

- ❖ To what degree is the implementation of existing regulations producing the results intended by the regulations? What changes in implementation may be needed to increase effectiveness, including cost-effectiveness?

- ❖ To what degree is compliance enhanced through understandable, consistently applied implementation? Where are changes needed to enhance compliance? What conflicts between regulations, if any, need to be eliminated?

- ❖ Is there effective management of compliance records and other compliance data?

- ❖ What resource levels, including staffing, are needed to enhance compliance, including to provide for timely and accurate review of development plans and permit applications and for adequate project inspections?

❖ Are current education and incentive efforts sufficient to encourage voluntary compliance? If not, what more is needed?

Step 3: Develop an on-going relationship with regulatory agencies to continue to identify resource, education, incentives and other needs for effective compliance and to provide public support for meeting those needs.

Background action 10

Problems addressed:

Regulations exist which, effectively implemented, would significantly improve the ecological health of the Elizabeth river. Compliance is diminished by a number of factors including lack of regulatory resources, lack of public education and incentives and inconsistent, illogical or otherwise ineffective implementation practices.

Stessors reduced:

Dissolved oxygen, nutrients, particulates, pathogens and toxics; loss of habitat and more.

Costs:

The estimated cost for this recommendation was based on each city adding one additional staff person and the Tidewater regional DEQ office adding two additional staff for enhancing compliance. The total cost is estimated at $250,000 to $300,000 per year.

Indicators for success:

Effectiveness of existing regulations in achieving intended results.

Discussion of step 1 and 2:

A key element in the strategy to improve the Elizabeth River should be timely and effective compliance with existing regulations. The effectiveness of these regulations is diminished to the degree that they are not fully understood and administered in a focused and coordinated manner aimed at enhancing water quality. Support for adequate funding to carry out the mandates is essential.

Improving enforcement of regulations where necessary to achieve program goals is recommended as one element of a broad approach including development of reasonable and understandable regulations and permit requirements and consistent application of those requirements to all projects. Timely and accurate review of development plans and permit applications, including development of the permits themselves, is also needed. Education and public information should be part of this comprehensive approach, along with more frequent project inspections and development of appropriate incentives to encourage voluntary compliance.

Program staff generally indicate that fair and consistent application of program requirements to all projects will result in improved compliance. Educational activities may reduce or eliminate the need for many enforcement actions through better understanding of programs and through encouragement of voluntary actions.

Understandable and reasonable regulations, which are consistent with each other, also lead to improved compliance. Some elements of existing programs conflict with each other. For example, current stormwater management regulations under the state and Chesapeake Bay Programs entail different thresholds and design criteria. Enforcement is difficult because of these differences. In other cases, strict enforcement of one program may cause a violation of another program or at least make compliance with the other program more difficult

Program staff also generally indicate that additional staff resources are needed to ensure

that effective permits and plans are developed and approved in an expeditious fashion and that subsequent inspections are accomplished on a regular basis.

In the context of a comprehensive program designed to achieve compliance, enforcement of existing regulations would appear to be effective, affordable and generally acceptable to the community. If viewed in isolation, enforcement is likely to be less than generally acceptable to the community, may be unaffordable at times of budget constraints and will not be as effective as the comprehensive approach.

Discussion of step 3:

The issues of affordability and acceptability must be framed in the context of the origin of the existing regulations. Most of the mandates were not initiated at the local level, yet local governments must shoulder the primary responsibilities associated with implementing these regulations. Program costs oftentimes fall directly on residents and businesses of a locality in the form of stormwater charges, permit fees and fines. Some local political leaders have expressed their concern over these costs, especially in light of the lack of clarity regarding the expected benefits of the programs.

To have a sustained, effective program to improve the water quality of the Elizabeth River, acceptance of the existing regulations is essential. Local residents and political leaders must have a clear understanding of the intent of the mandates and the anticipated benefits that are expected to be achieved. It is desirable to involve citizen and volunteer groups in the compliance program to achieve broad-based support.

Information needs to be compiled regarding the current status of compliance monitoring. This effort would include the following tasks: develop understanding of current level of regulatory compliance, identify best means for enhancement, identify amount of funding needed for program enhancement and develop a strategy for soliciting support for the proposed enhancements.

Section Three: Increasing use and enjoyment of the Elizabeth

Realizing the full potential of the resource

Goal: *To raise appreciation of the river's economic, ecological and recreational values.*

"The port of Hampton Roads was again the leader in foreign waterborne commerce on the East Coast and third in the entire US, with over 53 million short tons of cargo being handled in Hampton Roads in 1993."
Hampton Roads Maritime Association
Annual Report 1995

Action 11

Enhance marketability of Hampton Roads through achieving a cleaner environment, working with localities and the Chamber of Commerce's Plan 2007.

Steps for getting there:

1996 - 2000

Step 1: The Elizabeth River Project should work with the Commonwealth, localities and private partners to explore federally sponsored opportunities for enhancing economic vitality while at the same time achieving a cleaner Elizabeth River. The following opportunities should be explored for their ability to achieve both environmental and economic gains.

- EPA Brownfields Economic Redevelopment Initiative, providing funding of up to $200,000 for improving the economic viability of abandoned, idled or underused sites by cleaning up contamination.

❖ EPA Project XL Communities, providing flexibility for communities to implement their own community-designed and directed strategies to achieve greater environmental quality.

❖ EPA Sustainable Development Challenge Grants Program, providing funding for projects that leverage private investment in environmental efforts and those that link environmental protection with sustainable development and revitalization.

Step 2: Encourage local tourism bureaus, economic development departments and the Chamber of Commerce to become partners in river cleanup efforts out of recognition for the value that clean rivers play in a community's marketability to tourists and new businesses concerned about "quality of life."

Background action 11

Problem addressed:

Economic vitality and quality of life, including recreational and marketing opportunities, as impacted by pollution in the Elizabeth River watershed.

Stessors:

Contamination and widely-held negative perceptions regarding pollution.

Indicators for success:

Acreage of sites restored to higher economic and environmental health; ability of the community to achieve greater river health through flexible approaches also beneficial to the local economy.

Cost:

Matching local and/or private funding may be required. Cost-benefit should be high.

Discussion of Brownfields program

The EPA Brownfields Initiative is intended to "empower states, localities and other agents of economic redevelopment to work together in a timely manner to assess, safely clean up and sustainably reuse brownfields (EPA's Brownfields Action Agenda, 8/21/95)." *Brownfields* are abandoned, idled or under-used industrial and commercial facilities *where expansion or redevelopment is complicated by real or perceived environmental contamination.*

The program encourages community groups, investors, lenders, developers and other affected parties to join forces and *develop creative solutions to assess and clean up contaminated sites* and return them to productive use. Goals include helping participants better understand and overcome unnecessary or perceived liability barriers to the cleanup and redevelopment of brownfields. According to the Brownfields Action Agenda, the program will "help reverse the spiral of unaddressed contamination, declining property values and increased unemployment often found in inner-city industrial areas, while maintaining deterrents to future contamination and EPA's focus on assessing and cleaning up the worst sites first."

The program, announced in January 1995, is conducting pilot projects funded at up to $200,000 over two years. The pilots include testing of efforts toward removing regulatory barriers without sacrificing protectiveness. The EPA is also working on guidelines to clarify the liability of prospective purchasers, lenders, property owners and others regarding their association with the activities at the site.

It should be noted that the Brownfields program has raised some concern that cleanup standards will be lowered for these sites. Such concerns should be weighed with the possibility for the site's cleanup needs remaining unaddressed otherwise.

In a $200,000 pilot awarded to Cuyahoga County (Cleveland, Ohio), in 1993, $1.6 million in private cleanup dollars has been leveraged, $110,000 in private foundation money has been invested and over $625,000 has been generated in new tax dollars.

Discussion of Project XL Communities

The EPA announced this initiative in March 1995 as part of President Clinton's report, Reinventing Environmental Regulation. A limited number of communities are being awarded flexibility in the implementation of environmental regulations in exchange for a commitment to achieve greater environmental performance. Project XL does not provide grants, but rather flexibility.

The premise of this program is that environmental management actions tailored to local conditions can deliver greater environmental quality than uniform "command and control" approaches which structure solutions nationally. The payoff for communities is the ability to tailor environmental management strategies to local needs, thereby increasing efficiency and environmental quality. Monitoring and stakeholder involvement are both key.

Discussion of Sustainable Development Challenge Grants

This EPA grant program, also announced in March 1995, is intended to afford flexibility to fund a variety of environmental projects that could not be supported through traditional environmental program grants. Funding is for projects that leverage private investment in environmental efforts and those that link environmental protection with sustainable development and revitalization. Projects which meet these needs might provide an environmental focus to community projects, support initiatives which but for the federal contribution might not be viable or help communities converge around an environmental issue in partnership with the private sector.

Action 12

Increase public access to the Elizabeth River for the purpose of increasing appreciation of the river and support for restoration, where possible also taking into account the goal of:

- ❖ increasing vegetated buffer areas, wetlands, forested acreage and other habitat.

Steps for getting there:

1996 - 1997

Step 1: Elizabeth River Project should obtain a small grant to identify and publicize existing access sites, providing a map and lists of facilities available (six month turnaround). Use volunteers to contact local government officials. Have results formatted, professionally printed and distributed throughout the area, modeling the effort after Chesapeake bay Program's Chesapeake Bay Area Access Plan (1990).

Step 2: Initiate boat trips to expose children and adults to the beauty, history and recreational, economic and ecological values of the Elizabeth River. Continue current cooperative effort between the Elizabeth River Project and the American Rover passenger schooner to provide Elizabeth River educational opportunities to thousands of school children.

Step 3: Identify opportunities to support the expansion of existing public access projects, particularly those such as the City of Virginia Beach's Elizabeth River Nature and Canoe Trail which at the same time preserve wildlife habitat

Step 4: Develop additional access to the river on sites identified by previous studies including Chesapeake Bay Program's Chesapeake Bay Area Public Access Plan (1990).

Background action 12

Stressors:

Loss of support - public/legislative/administrative, ignorance, apathy.

Indicators for success:

Increased use of the river; increased support for clean-up initiatives.

Discussion of public access:

Public access can range from a mini-park on a street that dead-ends at the water to a major waterfront park with a boat ramp, picnic areas, and concession stands. The type of access will be dictated by the available land and the preferences of the local communities. Opportunities are modeled in other efforts including:

- ***The Elizabeth River Nature and Canoe Trail*** combines an educational nature trail with river access by canoe ramp and preservation of habitat. A 30-acre mix of woods and wetlands on the Eastern Branch in the Kempsville section of Virginia Beach, this project was completed in Spring 1995 as part of the City of Virginia Beach's new Virginia Beach Outdoor Plan. The nature trail is 3/4 mile long, meandering through the first "all natural" park in the city. A two-mile canoe trail follows a narrow portion of the Eastern Branch.
- ***An Elizabeth River Trail*** providing biking and walking ***access*** along the river from West Ghent to Larchmont was recently proposed to Norfolk City Council by a coalition of citizen interests, including representatives from Norfolk Southern Corp. Funding is being explored.
- ***The James River Association*** is developing a Greenway System that perhaps could be extended to the Elizabeth River.
- In addition, the ***Friends of the Chicago River*** have developed model programs to improve public access and appreciation of the Chicago River, including docent tours of the downtown waterfront. The American Greenways Program in Arlington is another resource on greenway development.

Action 13

Remove abandoned vessels and pilings, where possible also conserving or replacing habitat.

Steps for getting there:

1996 - 1997

Step 1: The 1996 General Assembly adopted a state budget amendment allocating $100,000 each year, 1996 and 1997, to the VA Marine Resources Commission for removal of abandoned vessels and other deteriorated structures in the Elizabeth River. The Marine Resources Commission has already mapped the location of derelict pilings, piers and vessels in the river.

1998

Step 2: Identify the owners of piers, pilings and vessels by consulting local property records or by determining the identity of vessels. Could be accomplished by volunteers.

Step 3: Meet with local US Coast Guard, US Corps of Engineers and VA Marine Resources Commission authorities to provide briefing regarding the information collected in steps one and two. Authorities seek funding to remove and dispose of the debris pursuant to applicable authority.

Step 4: Local authorities notify property owners that identified pilings and vessels will be declared abandoned and removed if not by property owner.

Step 5: Federal, state and local authorities acquire resources to remove debris. *Note:* At this writing, a budget amendment is before the General Assembly to provide $300,000 per year for 2 years to the VA Marine Resources commission "for projects to remove abandoned vessels, deteriorated structures, and waterway obstructions posing a hazard to recreational boating and the natural environment in the Elizabeth River."

Background action 13

Problem addressed:

Abandoned vessels are unsightly, contributing to negative attitudes about the river, and can leak pollution and cause navigation hazards. The Western Branch *alone* has at least 44 abandoned vessels and almost 500 abandoned pilings.

Indicators for success:

Number of abandoned vessels and pilings in the river.

Cost:

$500,000 - $1 million

Discussion of action 13:

The Elizabeth River is littered with hundreds of abandoned piers, pilings and vessels. This option proposes to locate the objects, identify the owner of the vessel or property, and procure the resources to remove those objects from the river.

Clearly the presence of old, rotting timbers planted in the river bottom, and the existence of decaying remains of vessels resting on the shoreline, or grounded on shoals, create an eyesore to the scenic panorama of the Elizabeth River. In addition, these pilings and vessels pose a hazard to navigation, not only to commercial traffic in the river, but also to recreational boats which use the river after dark. Human health issues are affected because these pilings can cause boating accidents with loss of life or serious injuries. Vessels and barges which come into contact with river debris may experience hull damage, resulting in groundings and sometimes the loss of the vessel. Accompanying such an accident is the discharge of oil or other hazardous substances into the Elizabeth River, thereby contaminating the river. Further, past contamination to the river is often absorbed in these wooden pilings and vessels and is gradually released during the hot days of summer when contaminations leach out of the pilings.

The authority to direct the removal of abandoned property in the Elizabeth River lies with the US Corps of Engineers, the VA Marine Resources Commission, and to some extent the US Coast Guard. Consequently, the cooperation of these agencies is crucial to the success of this option. In addition, funding will be necessary to pay for removal and disposal of the river debris, action which may be costly for vessels currently abandoned in the river. Preliminary polling indicated *widespread support* for this option, especially from boaters and those who make their living upon the Elizabeth River.

Abandoned pilings and vessels pose the most significant threat when they are located in or near the navigable channel, or in areas of high recreational boat activity. Therefore, it is recommended that the navigable channels be cleared of this debris first. Also, abandoned pilings and piers located in the area between Lambert's Point and Town Point would add both safety and visual benefits.

Once pilings and vessels are completely removed from the river, the threat posed by the objects are completely eliminated. The leaching from the debris, as well as the danger posed by their presence in the river, are completely eliminated by their removal. The effectiveness of this option is only reduced by the possibility that these pilings and vessel provide a habitat for aquatic life which cannot be replaced.

The cost of removing pilings and piers is very affordable and can be accomplished for very little investment. Several salvage companies have offered to remove the pilings free of charge, provided disposal costs are paid. Expense centers on disposal costs and removal of sunken wrecks. Wreck removal can be dangerous and requires expensive equipment. Any oil soaked debris must be properly disposed of at substantial cost.

Surveys have not revealed any substantial opposition to this option. Volunteers have stepped forward to offer cooperation in the removal of pilings and piers.

Section 4: Increasing our knowledge about the Elizabeth River

Making more informed decisions

Goal: *Develop and implement a dynamic, state-of-the-art Watershed Action Plan that is effective... affordable... and acceptable.*

"If you don't know where you're going, you'll probably end up someplace else."
DH Lawrence

Action 14

Establish and maintain an Elizabeth River monitoring program and data bank to provide the scientific foundation for protecting, restoring and sustaining living resources and human health in the Elizabeth River watershed.

Steps for getting there:

1996 - 1997

Step 1: At the request of the Elizabeth River Project, the 1996 General Assembly adopted a state budget amendment providing $125,000 a year for two years to enhance toxics monitoring capabilities of the VA Department of Environmental Quality. Speaker Thomas Moss of the House and State Sen. Stanley C. Walker were early patrons of the bill. The budget amendment was requested to enhance toxics monitoring capabilities of DEQ as one part of a comprehensive monitoring and data collection program, also pooling other local and private resources. During the first year, scientific, citizen, business, academic and government interests should be brought together for facilitated discussions of: a) achieving an effective monitoring program; b) resources to be pooled from the public and private

sector. A centralized data bank should be established and improved DEQ monitoring begun.

Step 2: To facilitate comprehensive monitoring, obtain the support of relevant leadership for the establishment of an Elizabeth River Monitoring Program and Databank (ERMPD). The endorsement of relevant leadership for a basic monitoring approach and generalized goals should be obtained in the context of seeking leadership support for the entire Action Plan. More specific monitoring goals should then be developed to assist with monitoring progress toward achieving actions outlined in the plan.

Step 3: Relocate Elizabeth River Geographic Information Survey datasets to a central databank location and begin using to 1) generate analyses in support of monitoring and management planning, 2) provide data to others involved in watershed management as feasible.

1997

Step 4: Begin recommended research elements needed for monitoring effectiveness, including development of toxics indicators, sediment criteria, modeling and other data needs for strategic loads allocation.

Step 5: Complete integration of existing datasets.

Step 6: Produce first annual State of the Elizabeth River monitoring report on 1) monitoring results, 2) monitoring improvements made or planned from research elements, 3) management action effectiveness, 4) recommendations to improve management actions.

Background action 14

Problem addressed:

Monitoring provides the only sound basis for guiding and measuring the effectiveness of actions outlined in this plan. Without a system to consistently measure conditions on the river over time, we may be unable to tell if these efforts actually make a difference at all.

Stressors:

All significant stressors identified in this plan should be monitored.

Cost:

Program costs could be in excess of $500,000 a year; could start smaller.

Indicators for success:

Availability of sound data to make and track environmental management decisions.

Discussion of action 14:

This initiative received strong support from across all river sectors represented on the Watershed Action Team. However, a widespread perception exists in the Elizabeth River

community that "the river has been studied to death--it's time to do something." With others, general skepticism of science may cause resentment of murky, abstract expenditures. Both of these concerns have valid roots in 1) the lack of regular, objective reporting on monitoring results to the public, and 2) a frequently unclear connection between the weight of science and management actions. These concerns can be allayed through a leadership group that:

- commits to providing a peer-reviewed, annual report on the health of the Elizabeth River,
- publicly sets management goals clearly linked to these reports, and
- publicly and objectively reports, on an annual basis, on its own successes and failures in meeting its goals (see partnership action).

Reasonable concerns from leadership may arise related to making commitments which may lead to failure, or reporting complex information that may be misunderstood and cause undue alarm. With the complex issues facing the Elizabeth River basin, however, the Watershed Action Team strongly believes that the best tactics for bringing the community together and winning its trust and participation are strong, goal-oriented environmental leadership, combined with an honest and open assessment of facts.

It is recommended that the following goal and objectives be adopted by the ERP Leadership Review Board.

Goal: *"We agree to establish and maintain an Elizabeth River Monitoring Program and Databank, which will provide the primary scientific foundation for protecting, restoring and sustaining those living resources and aspects of human health dependent upon the Elizabeth River and its tributaries."*

Objectives:

1) Establish baseline environmental conditions of the Elizabeth River watershed and measure changes in those conditions over time. This will be accomplished by:

- ❖ Measuring water column, sediment, biota, habitat, and inputs.
- ❖ Measuring the health of both the river as a whole and specific problem areas.
- ❖ Establishing a central Elizabeth River Monitoring Databank.
- ❖ Insuring availability of all data to the public in reasonably usable form, including digital files.
- ❖ Maximizing usefulness of existing data and previous efforts.
- ❖ Minimizing duplication of effort.
- ❖ Regularly reviewing and optimizing monitoring to maximize cost-effectiveness.
- ❖ Developing optimal environmental indicators.
- ❖ Providing an annual public report on the State of the Elizabeth River, which is understandable and objective, containing 1) a comprehensive analysis of monitoring results, 2) a report on progress in monitoring improvements, including research initiatives, 3) relative effectiveness of Elizabeth River management actions.

2) Understand the causes, natural and anthropogenic, of observed changes in or related to the Elizabeth River and its tributaries.

3) Determine the effects of observed changes on living resources and aspects of human health dependent on the Elizabeth River and its tributaries.

4) Provide information on the river system's observed or predicted response to specific watershed management activities.

5) Provide data necessary to support watershed management activities, including those recommended by Watershed Action Team in the areas of land use, habitat, contaminants, fisheries and wildlife management.

Business and city representatives on the Team expressed support for efforts to improve knowledge of sources of stressors in the Elizabeth River, as this will enhance fair and equitable distribution of monitoring and mitigation responsibilities, and help them target their own

environmental programs more effectively. Several facilities with discharge permits, in fact, expressed willingness to expand monitoring in cooperation with government agencies, including bringing additional resources and funding.

The cost of the Monitoring Program and Databank will be significant. The magnitude and complexity of activities in this watershed are of a level unsurpassed statewide, and therefore will demand significant funding to adequately track effects and guide improvements.

Following agreement to monitoring objectives by principal leaders, a team of scientists and engineers should be assembled to develop a detailed Monitoring Program and Databank proposal, with accurate cost estimates. A well-crafted proposal might describe alternative levels of monitoring, each with a clear statement of its respective costs and benefits. From these, resource sponsors could select the level of monitoring that offers the best balance between meeting the need for environmental information and the availability of funds.

It is recommended that all sectors of the Elizabeth River community, public and private, volunteer to dedicate ongoing, stable funding or other support to implement monitoring initiatives. In addition, the Watershed Action Team has several specific recommendations for resource sources:

- **Private industry**--initiate and maintain voluntary sampling of its discharges for stressors in the Elizabeth River.
- **State government**--maintain role as primary lead on water-quality monitoring. Support habitat, living resource monitoring.
- **VA Dept. of Environmental Quality**---reallocate state-owned surplus properties such as the mobile toxics lab and equipment to the regional office for support of an in-depth, long-term program in the Elizabeth River.
- **Hampton Roads Sanitation District**--provide laboratory space, services and expertise.
- **Federal government (U.S. EPA, U.S. Army Corps of Engineers, Dept. of Defense)**--provide grants and possible surplus materials (boats, trucks, monitoring equipment).
- **Educational institutions**. Primary schools--conduct ambient stream monitoring as field trips. High schools--use monitoring programs to improve math, chemistry, biology and administrative skills. (Global Rivers Environmental Education Network already involves a number of local high schools in Elizabeth River water-quality monitoring). Universities--partner students with lower-level students to collect, collate and perform technical analysis on data and formulate reports on a regular basis. Tidewater Community College may be able to provide a boat and student volunteers for ongoing sampling programs.
- **Cities**--work with the proposed council to coordinate stormwater monitoring programs targeted for Elizabeth River improvement goals.
- **Hampton Roads Planning District Commission**--provide repository and staffing for the Elizabeth River Databank, including an Elizabeth River geographical information system. Provide general technical support and coordinating functions to implement council goals.

Citizens--participate in smaller community volunteer monitoring projects. Become informed participants in local government, including setting and targeting of utility fees to help accomplish watershed monitoring of residential impacts.

(A fuller exploration of this action is available in the discussion paper, "Elizabeth River Monitoring Program and Data bank")

Action 15

Determine ecological effects of Craney Island operations on the Elizabeth River, with the purpose of reaching consensus among interested parties about best management practices and remediation needs.

Steps for getting there:

1997

Step 1: Design a comprehensive, independent, technologically sound study intended to generate new data and provide the basis for recommending possible improvements. The Elizabeth River Project could serve the lead role. Stake-holders and beneficiaries should be involved in both planning and financing the study. Study and results should be written in "plain English" understandable to the general public. Review existing pertinent literature, rules, regulations & permits; design study, obtain financial support, organize study team.

1998 - 1999

Step 2: Complete data collection.

Step 3: Complete data analysis, any recommendations for possible improvements, report preparation and distribution.

Background action 15

Problem addressed:

Craney Island is a 2,500-acre confined site operated at the confluence of the Elizabeth and James Rivers for the disposal of dredged material. Questions have been raised about the possible escape of contamination from these dredged materials, although no studies have identified any major pollution problems.

Cost:

The exact cost of such a study cannot be accurately estimated prior to completion of the study design. The preliminary work necessary to design a study (a review of the scientific literature, rules, regulations, permits and previous Craney Island studies) and a preliminary report would cost from $15,000 to $20,000.

The cost of this study would be justified by:

- The significance of Craney Island as one of the world's largest confined dredged and material placement areas.
- The lack of a comprehensive ecological impact research program for Craney Island.
- The possibility that Craney Island will be expanded and/or used for dredging materials that are not suitable for ocean disposal.
- The need to educate the public about the ecological effects of Craney Island operations (positive or negative) in order to achieve consensus about best management practices.

- The opportunity to develop a new generation of best management practices for Craney Island and other dredging disposal areas.
- The opportunity to identify needs for ecological remediation, if any.

Discussion on action 15:

Craney Island is the major active placement area for dredged material in Hampton Roads. Studies have been done over the years to assess various aspects of its environmental impact. While none of the studies that have been conducted has identified any major pollution problems, some have raised questions and made recommendations that have fueled persistent concerns in the community about Craney Island operations. A comprehensive scientific study should be done to answer the question: what are the ecological effects of Craney Island operations on the Elizabeth River?

The contaminants in the Elizabeth River bottom sediments are transferred to Craney Island during dredging operations. During transfer operations and storage, opportunities exist for contamination and sedimentation problems by effluent flow, groundwater flow, surface run-off, volatile emissions and plant and animal uptake. The Sediment Task Force has focused on three areas of concern:

- Transfer of dredged materials into the rehandling basin and subsequent re-dredging for deposit into the disposal area.
- Effluent, including pore water released by dredged material de-watering and surface run-off.
- Sediment released from the containment area.

The U.S. Army Corps of Engineers/U.S. Environmental Protection Agency publication Technical Framework for Dredged Materials Management (November, 1992) provides guidelines for the evaluation of contaminant pathways of concern: effluent, surface run-off, groundwater leachate and plant and animal uptake. It suggests evaluation techniques for each pathway. These guidelines would provide a framework for the recommended study.

This project should involve all interested parties including beneficiaries of Craney Island operations. A lead agency should be selected which does not have an immediate vested interest in Craney Island operations. The Elizabeth River Project could well serve this role. The planning and financing of the study should involve a coalition of interested parties in order to maintain the spirit of civic cooperation that is appropriate to a study of this important public facility.

(Further elaboration of this action was developed in the discussion paper, "Final Report: Assure BMP's at Craney Island," available separately.)

Action 16

Develop and implement a "load allocation approach" as a voluntary tool for making more informed, more cost-effective decisions on how to manage the Elizabeth River.

Steps for getting there:

1996 - 2000

Step 1: With VA DEQ as the lead agency, prepare a "load" inventory documenting all point and non-point source pollution input to the river. URS Consultants has completed much of this work as background technical reports for this action plan.

Step 2: Calculate the "load capacity" of the river, or the amount of pollutants the river can assimilate without impacts to environmental quality. Modeling the river's flow is a major part of this step and is near completion under the direction of Dr. David Bascoe at Old Dominion University. Next is modeling where contaminants end up as a result of that flow pattern.

Step 3: Prepare "load reduction targets." Determine the amount of pollutant which must be removed in order not to exceed the river's ability to assimilate the pollutant ("load capacity").

Step 4: Suggest "load" levels allocated among point and nonpoint sources consistent with target reductions. This step can create "pollutant trading opportunities" which can encourage more cost-effective environmental results ("the biggest bang for the buck").

Step 5: Suggest appropriate allocations and management strategies based on what we have learned.

Background action 16

Problem addressed:

The need for improved ability to understand and predict pollutant impacts in the watershed and the need for checks and balances to assure that resources are spent on the greatest environmental needs.

Stessors:

All in the watershed.

Costs:

Funding is envisioned to be obtained from grants. Funding may also be obtained from stakeholders if they feel that the load allocation process will ultimately benefit them by reducing their costs for toxics reduction activities. Total costs at one point were estimated to range up to $2 million; however much of the work is already completed.

Indicators for success:

Cost effective watershed improvements.

Discussion of action 16:

This reduction action is not intended to be used in a regulatory context. This reduction action involves the development of load allocations for point sources and for stormwater runoff. The load allocation quantifies the maximum allowable loading of a pollutant to a water body, and allocates this loading capacity to contributing point and nonpoint sources.

EPA encourages the development of load allocations that reflect the tradeoffs between point and nonpoint sources where such tradeoffs achieve the desired environmental results.

Load allocations could become the most important aspect of this plan. They serve as a "blueprint" for making informed decisions concerning the effectiveness of other reduction actions. Load allocations address the impacts of all stressors, since they account for all of the environmental media present in and put into the river. Load allocations consider the effects of pollutant loadings as they relate to sediments quality impacts, water quality impacts, and impacts to biota and human health. The use of load allocations as a guiding strategy allows a system of checks and balances to be put into place to assure that resources that are being expended on reduction actions that are believed to be effective, but are not, are reappropriated to more effective endeavors. Load allocations also allow a determination to be made as to (1) when have we gone far enough, and (2) when will "the straw break the camel's back."

Water quality standards do not exist for many of the pollutants of concern in the Elizabeth River, and to evaluate their impacts based purely on water quality is misleading.

Establishing load allocations involves determining that amount (loading) of a pollutant that can be assimilated by a receiving stream, and that can be predicted to not cause an exceedence of a particular effect. These effects can be related to sediment quality impacts and water quality impacts, as well as human health impacts resulting from food chain accumulation of the pollutant. Once a load allocation is established the relative contributions of the pollutant from point and nonpoint sources are determined, and the load allocation allocated between the sources such that the resulting cumulative discharge would not be predicted to exceed the load allocation.

In developing a load allocation for a stream segment all sources of contamination and potential receptors should be adequately addressed and modeled. In concept a load allocation may be developed and implemented for any pollutant in any waterbody. Decisions to develop load allocations should be based on sound data which takes into account all potential receptors including sediments. The following procedure is commonly used to develop load allocations.

Load allocations have been established in other waterbodies in the U.S.. The State of Washington has recently embarked on an effort to develop load allocations for 23 watersheds in a five year period. The State of North Carolina has also recently applied the load allocation concept in the Tar-Pamlico Basin.

Action 17

Develop a nutrients task force to establish Elizabeth River nutrient goals and basis for goals, and to recommend control measures needed to achieve goals.

Steps for getting there:

1996

Step 1: Form a nutrients task force including liaison representation on the Hampton Roads Tributary Strategies work group, established under coordination of the Hampton Roads Planning District Commission to evaluate potential nutrient reduction strategies for Chesapeake Bay tributaries.

Step 2: Establish nutrient goals and basis for goals;

Step 3: Evaluate existing data;

Step 4: Recommend further studies where existing data is insufficient to establish nutrient goals.

2000

Step 5: Develop a comprehensive water quality model for the river to evaluate nutrient flux, determine the dominant sources and explore the effectiveness of different control strategies;

Step 6: Recommend those nutrient control measures needed to achieve goals (i.e. BMPs, limits, standards etc).

Step 7: Follow through to ensure that the recommended controls are implemented.

2005

Step 8: Assess the effectiveness of the recommended controls.

Background action 17

Problem addressed:

Excessive nutrient pollution is well recognized as a serious problem of the Chesapeake Bay and its rivers. At the same time, high uncertainty exists regarding appropriate nutrient reduction goals and controls for the Elizabeth.

Stessors:

Nutrients

Indicators for success:

Changes in nutrient levels.

Discussion of action 17:

The purpose of this paper is to identify: (1) strategies that may increase "affordability" and (2) strategies that may increase "acceptability" to the community -- in each case, without compromising effectiveness.

The following options were considered for the formation of the task force:

(a) formation of an independent nutrient task force. This option was considered the least practical since it could involve "re-inventing the wheel". Increased costs, potential duplication of existing efforts, and/or conflicting recommendations could result.

(b) formation of a nutrient task force to liaison with the Hampton Roads Tributary Strategies (HRTS) group. This idea probably represents the best approach since the existing HRTS effort may have much to offer the ERP. Potential liaison functions are listed below:

- research the HRTS relative to issues unique to the Elizabeth River and to see how they accomplish the ERP objectives. An overview of the Hampton Roads Tributary Strategy is given in Attachment #1 of the discussion paper, "nutrients Task Force," available separately).

- ensure that information from the existing efforts are best utilized in the ERP process;
- recommend revisions to the HRTS effort to enhance resolution for the Elizabeth River; evaluate funding needs for these request(s);

The costs associated with the nutrients task force need further study. Actual costs would be dependent upon the degree of detail that existing efforts (already funded) will address ERP objectives. If many objectives are met then costs would be relatively "low". The inverse is also true. The task force could explore further funding of the existing effort to enhance specific details needed for the Elizabeth. This could prove more cost effective than carrying out an independent effort.

The membership of the ERP nutrients task force has not yet been determined. Potential membership could include some currently involved in both the HRTS and ERP. The ERP nutrients task force should maintain a "balanced" membership to ensure broad acceptability.

In the future, high capital costs could be a potential obstacle to implementation of nutrient control measures recommended by the task force. Point and non-point source nutrient controls are generally much more difficult and expensive to implement than conventional pollutant controls. The regulated community needs to be reasonably convinced that the recommended actions will result in tangible improvements to the water quality and/or biological condition. Involvement of the regulated community in the task force will help improve acceptability of the recommended actions.

Section 5: Creating an Active Partnership to Manage & Maintain a Healthy River

Working Together

Goal: *Forge partnerships between citizens, industry, scientists and government. Balance competing uses.*

"A river is more than an amenity, it is a treasure. It offers a necessity of life that must be rationed among those who have power over it."
Justice Oliver Wendell Holmes

Action 18

Build strong partnerships between the Elizabeth River Project and all public and private authorities relevant to this plan, for the purposes of ensuring public input and support; achieving environmental equity; promoting speedy, effective implementation, and enhancing regional watershed planning.

Steps for getting there:

1996

Step 1: Establish an "implementation structure" for the Elizabeth River Project's Watershed Action Plan that ensures on-going involvement in restoration accomplishments and planning by those in the highest levels of authority. The implementation structure should provide for leaders to

reach voluntary agreement on mutual goals, with an annual, high-profile report on successes and failures in meeting those goals and subsequent adjustments to implementation efforts. The members of the Elizabeth River Project's new Leadership Review Board are key to regional cooperation in carrying out the plan.

Step 2: Leadership support should be one part of efforts by the Elizabeth River Project to establish on-going working relationships with:

- Watershed businesses and their trade groups and umbrella organizations, in particular those dealing directly with river-related commerce, to maximize common goals.

- Residents of the watershed to encourage their participation and support for river improvement efforts.

- Environmental justice-related groups, including the NAACP and Hampton University's environmental justice program.

- The Commonwealth of Virginia, to provide public support and promote speedy, effective implementation of pollutant reduction initiatives outlined in this plan, as well as other river improvement initiatives involving the State.

- The Cities of Norfolk, Portsmouth, Chesapeake and Virginia Beach, to provide support and education initiatives for enhanced river improvement efforts, particularly those involving municipal stormwater management, public access and the protection of environmentally sensitive areas, and opportunities to enhance the economy through river clean up (see related action).

- The Hampton Roads Planning District Commission, the Hampton Roads Sanitation District, the Southeastern Public Service Authority and other regional authorities to maximize efforts toward mutual objectives, eliminate duplication and tap extensive technical and planning capabilities.

- US Congress, VA Senate and VA Governor, City Councils and all other pertinent elected officials, to obtain support for implmenting the Action Plan.

- The US Army Corps of Engineers, to provide public support and promote speedy, effective implementation of its Elizabeth River Basin reconnaissance study and restoration initiatives.

- The US Navy and other arms of the military, to maximize common efforts to restore and protect environmental quality, particularly on property owned by the military.

- The Chesapeake Bay Foundation, The Alliance for the Chesapeake Bay, the Sierra Club, The Nature Conservancy, Virginia Environmental Network, the Audubon Council, Clean the Bay Day, SAVE and other environmental initiatives, to maximize efforts toward common goals.

- Educational and scientific institutions, including colleges, universities and schools, to promote research, achieve technical integrity and maximize education of the public on the values and needs of the Elizabeth River.

- River-oriented recreational organizations, including Festevents and Ports Events, boat clubs, and watersports teams, to maximize appreciation and enjoyment of the river.

Origins of the Watershed Action Plan

Genesis of the Elizabeth River Project

Four citizens sitting around a kitchen table in November 1991 hatched the idea of organizing a grassroots effort to restore the environmental health of the Elizabeth River. The degraded state of the river had become well-known through decades of headlines reporting blind, deformed and cancerous fish in the highly urbanized river. Government and industrial efforts to curb pollution had made significant headway since the Clean Water Act of 1973. But some problems, including contaminated river sediments and storm water run-off, the latter newly identified as the river's leading source of pollution, appeared too large and intractable to be solved without a new level of community interest and awareness, with the resulting willingness to pool resources and pursue new solutions.

The four citizens decided to test the popularity of pursuing heightened community involvement in the fate of the Elizabeth. With two more volunteers and seed grants of less than $2,000, the fledgling "Elizabeth River Project" interviewed 65 community leaders from all walks of life during spring and summer 1992. Did these leaders value the Elizabeth River? What did they perceive as the river's biggest problem, and what, if anything, did they want done about it? The findings: Community support appeared favorable for a community partnership to tackle the river's problems. The vast majority of community leaders interviewed said the river is under-valued for its economic, recreational and aesthetic contributions to Hampton Roads and its health should be improved. A **non-finger pointing, consensus building approach** was frequently recommended.

On Sept. 10, 1992, thirty community leaders came together for the first meeting of an Elizabeth River Project "Advisory Board." Participants marveled on the novelty of sitting side by side with competing interests -- regulatory, business, environmental, recreational, military, scientific -- to discuss common goals for the Elizabeth River. A commitment to including all interests in the search for solutions

has remained a hallmark of the Elizabeth River Project. Incorporated in April 1993, the project has modeled its early planning phases to reflect Advisory Board directives to find a consensus among government, citizen, business and scientific interests.

Choosing a model for consensus

The Elizabeth River Project needed a structured way to build consensus among diverse interests, and it needed funding for the process. Marine Scientist Dr. Robert J. Huggett, then vice president of the Project's new Board, was an author of a high-profile EPA document, *Reducing Risks*, calling for a new planning approach wedding science with public values for stronger policy decisions. Huggett suggested that the Elizabeth River Project try this approach as modeled by the State of Michigan's Comparative Risk Program. To set environmental priorities, Michigan established a Citizen Committee, a Government Committee and a Science Committee. Each committee drew up a list of Michigan's environmental ills. The committees then exchanged lists and learned from each other as they developed an informed consensus.

In fall 1993, the Elizabeth River Project was awarded two-year grants of $50,000 (later upgraded to $74,000) from the EPA's Regional and State Planning Branch and $20,000 from the Virginia Environmental Endowment to conduct an assessment and ranking of risks in the Elizabeth River watershed, following Michigan's Comparative Risk model.

Phase I: Assessing the seriousness of the problems

On March 17, 1994, the Elizabeth River Project held an overnight retreat in Yorktown to launch three committees whose job would be to reach agreement among diverse interests on the Elizabeth River's most serious problems.

The Citizen/Industry, Government/Agency and Scientific/Technical Committees numbered 80 volunteers representing a broad spectrum of concerns. Members ranged from the Captain of the Port for the US Coast Guard to a representative of the Garden Club of Norfolk; from the treasurer of the South Tidewater Association of Ship Repairers to the director of the Applied Marine Research Lab at Old Dominion University.

The committees **first identified their own lists of problems,** then exchanged lists and came to agreement on a final list to be researched and ranked. Scientists and engineers from the committees developed technical reports on the degree of risk posed by each problem to human health, environment and quality of life. At a culminating retreat Nov. 17-18, the three committees reached unanimous agreement on a ranking of high, medium or low risk for nine out of the 10 problems before them.

Ranked "high risk" were:

- Sediment Quality and Sedimentation Processes;
- Loss of Habitat & Biota
- Non-Point Source Pollution,
- Point Source Pollution (the only ranking not unanimous).

Medium risk:

- Contaminated Groundwater
- Hazardous Materials Transportation & Storage
- Altered Hydrology
- Dredging & Dredged Material Placement.

Low risk:

- Vessel Discharges
- Non-Indigenous Species.

Results of the ranking were announced to the public at the Elizabeth River Project conference, "Elizabeth River: Strategies," on Jan. 10, 1995 at the Norfolk Waterside Marriott. All 240 participants were invited to brainstorm ideas and to volunteer for task forces for the next planning phase: "risk management," or what to do about the high risk problems.

Phase II: Researching a plan to manage the worst problems

The ranking provided the Elizabeth River Project with a strong focus for its final planning phase, designing an Action Plan. On April 27, 1995, the Project launched a new "Watershed Action Team" charged with planning state-of-the-art strategies for addressing each of the high risk problems identified in phase one. The team included three work groups focusing on these **high risk problems**: a Habitat & Living Resources Task Force, a Sediment Quality Task Force and a Water Quality Task Force, the last addressing both point-source and non-point source pollution.

The team also included a fourth work group, the **Toxics Reduction Team**, requested by the Commonwealth of Virginia to provide stakeholder recommendations on how to reduce toxic impacts in the Elizabeth River. Virginia Secretary of Natural Resources Becky Norton Dunlop was keynote speaker as the four work groups kicked off with a tour of the Elizabeth aboard the Carrie B.

The team's membership represented the greatest diversity yet of any Elizabeth River Project board. By June, the team had agreed to a common vision and common goals and begun the work of developing a common understanding of the problems, including identifying the major river stressors. By Sept. 11, each work group had identified a preliminary list of promising actions. Criteria for arriving at a final list were developed, emphasizing three areas of research: effectiveness, affordability and acceptability to the community. A first draft, based on the first leg of research, addressing effectiveness only, was finished by Nov. 13.

To assure that the plan takes into account the needs and concerns of the larger community, presentations on the draft plan were made to interest groups in November, December and January. A summary of the plan and questionnaire on acceptability was mailed to about 1,000 residents during this period and results provided to the Watershed Action Team for final deliberations. In addition, leaders representing the highest levels of authority, knowledge and influence on river issues were recruited to provide feedback on a "Leadership Review Board." Additional team research of "affordability and acceptability" was concluded Jan. 31. The

Watershed Action Team reached consensus on an action agenda based on this additional research at a retreat Feb. 29/March 1.

Virginia's toxics reduction commitment

For a decade, Virginia has been a partner with other states along the Chesapeake Bay in commitments to restore the health of the Bay. In 1994, Virginia Governor George Allen carried on the commitment by signing an agreement to develop a plan for reducing toxic impacts in three Bay Regions of Concern. One of the three Regions of Concern is the Elizabeth River.

Consultants to the tri-state Chesapeake Bay Program recommended assembling stakeholder teams to design the "Regional Action Plans" for reducing toxic impacts. Meanwhile, staff of the Virginia Department of Environmental Quality had been committee members during phase one of the Elizabeth River Project's planning efforts and were aware of the Project's parallel schedule for developing an Action Plan on related issues. An agreement was signed in March 1995 for the Commonwealth to assist with funding and technical support while the Elizabeth River Project incorporated the toxics component into its plan development.

Implementation Structure

Elizabeth River Project Board of Directors

- Serves in catalyst role to ensure that the Watershed Action Plan is carried out by those organizations with the most appropriate authority and capabilities. Where no appropriate authority exists or where those with the authority remain hesitant, the project considers acting in catalyst role to form new partnerships, or considers directly carrying out demonstration or education projects in order to sell the action to others on a larger scale.
- Designs, seeks funding for, appoints and is ultimately responsible for volunteer Implementation Committees.

Elizabeth River Project Ad-hoc Implementation Committees

- Volunteers from diverse interests who help ensure the transition into implementation by making contacts, following up, monitoring progress and adjusting plans as needed.

Leadership Review Board

- This board was established in 1995 to represent the highest levels of authority, influence and knowledge on river issues. The review board has commented on the first draft of the plan and has been asked to provide comments on the final draft before it is made public. The purpose is to make sure that actions take into account the interests and

concerns of the larger community, especially those with authority to assist with implementation.

- **Public Involvement Committee** - This committee plans activities to build support for the Watershed Action Plan, including a major annual conference. The mission of the Public Involvement Committee is to assure acceptability of the plan in the community.

- **Ways & Means Committee** - This committee finds funding for action implementation, including securing grants and organizing fund drives.

- **Technical Review Committee** - Technical assistance and review will be needed during the implementation phase of the Watershed Action Plan. A technical review committeee is envisioned to assure the scientific integrity of actions as they proceed.

Ecological health of the Elizabeth River

Excerpted from background technical reports by URS Consultants, 1995, developed for the Toxics Reduction Team of the Watershed Action Team. This section provides an overview of the physical setting, the habitat, and the species which inhabit the Elizabeth River watershed. Much of the material is from two sources (Huggett, R.J., et al., 1992; Chesapeake Bay Executive Council, 1988.).

Physical Setting of the Elizabeth River Watershed

The Elizabeth River is a simple tidal estuary consisting of a main stem and three major branches. It has been changed from the once typical marsh-lined estuary by several centuries of channel dredging, bulkheading, and filling. The most recent stage, the diking and filling of Craney Island (a dredged materials disposal area), has lengthened the mainstem of the river by several kilometers and isolated much of the Port Norfolk area. The present river, particularly the mainstem and the Southern and Eastern Branch portions, is characterized by a single deep central channel, fringed by shallows, tidal flats, and developed shorelines. The Eastern Branch divides the industrial center of the city of Norfolk and is lined by industry, with residential areas in Virginia Beach. The Southern Branch is the longest section of the river and is lined by industries including the world's largest naval shipyard. It routes the major small boat traffic of the Intracoastal Waterway around the Dismal Swamp into the Albemarle Sound, North Carolina. The Western Branch is somewhat different. It joins the mainstem near the river's mouth and has multiple relatively shallow channels; its shoreline is primarily residential, and natural marsh areas are abundant. The physical nature of the Elizabeth River is such that little flushing of contaminants occurs. The tidal currents are relatively slow, and the freshwater influx is low due to canal locks on the upper river, which regulate flow. Dredging is responsible for most of the removal of contaminants in sediments, but this is operative only in and at the edges of the channel. The shipping channels are heavily used and are maintained by the

Corps of Engineers. This maintenance consists primarily of removing shallow spots caused by slumping of channel edges.

Fish and Wildlife Habitats of the Elizabeth River Watershed

The variety of habitats within the lower Chesapeake Bay, including the Elizabeth River, can be classified using the two most basic factors controlling the distribution of Bay biota: water depth and salinity. In this classification of habitats, gradients of depth and salinity can be divided into descriptive zones. Depths range from the deepest troughs and channels in the mainstem Elizabeth River to the intertidal shores and upland areas bordering tidal waters. Within these zones, many other physical and biotic factors such as sediment type, the presence of food and cover, the strength of waves and currents, water temperature, dissolved oxygen, and habitat contamination and disturbance control the distribution and abundance of living resources. A generic system of habitat zones offers a simplistic way to classify, describe, monitor, and manage living resources in the Elizabeth River.

Upland Shore Zone

A variety of vegetation types exists on the upland shores that are the terrestrial communities at elevations above the influence of tides. Upland shore zones are dominated by typical terrestrial field grasses, trees, shrubs, and weeds. These zones are frequently utilized by invertebrates, insects, waterfowl and upland birds, mammals, and humans. In many cases, the physical nature of these upland regions is heavily influenced by human activities, especially development and agriculture. Several species that depend upon Bay aquatic habitats also rely upon these terrestrial environments for food, cover, or nesting sites. Examples of these species include the bald eagle, Canada goose, river otter, beaver, and raccoon.

Upland areas are subject to contaminants originating from mosquito control pesticides, agricultural chemicals, toxic waste dumping, aerial drift, and stormwater runoff. The contaminants from these activities can affect both aquatic and terrestrial organisms, food resources, and habitats. A prime example of such an impact is directly related to a protected species, the bald eagle. The historic application of DDT to agricultural fields resulted in contamination of foood sources (fish) and habitat (vegetative cover) of the bald eagle. The net result was the adverse impact to reproductive success and survival which eventually led to the enactment of the Endangered Species Act.

Intertidal and Littoral Zone

The intertidal and littoral zones include areas with water depths of approximately 0.5 meters (m) or less. They are semi-aquatic habitats, covered periodically by tidal waters or washed by waves. These zones include marshes, sandy beaches, mudflats, and man-made shoreline structures such as revetments and bulkheads. Saltmarsh cordgrass *(Spartina alterniflora)* is the most common type of vegetation observed in the marshes and along shorelines. This semi-submerged plant is a major habitat component of wetland systems, providing

shelter and serving as a food resource for many fish and wildlife species. Mudflats have a common association with saltmarsh cordgrass. They are readily observed at low tide. Mudflats provide substrates for many benthic invertebrates that are food resources for various species of fish and wildlife. Representative species include shorebirds, waterfowl, muskrats, many benthic invertebrate species, and larval or juvenile stages of finfish and crabs.

Shallow Water Zone

The shallow water zone (to a depth of < 3 m) includes the uppermost waters over the surface of the entire Bay and its tidal tributaries as well as the bottom sediments in the shallow-water areas. Shallow water zones are typically those shallow waters that lie between low and high tides. These zones are usually readily observed in small creeks leading into tidal marshes. Examples of important resident organisms include submerged aquatic vegetation, waterfowl, shallow-water benthic species, crabs, and most juvenile finfish.

Non-point source pollutants make their biggest impact on the intertidal, littoral, and shallow water zones where the majority of fish and wildlife species can be found in their early life stages. Contaminants originating from point, i.e. direct discharge, and other non-point sources are at their maximum concentration when entering the shallow water habitats. As a result, fish and wildlife are often exposed to some of the most severe environmental conditions during their most sensitive life stages.

Mid-Water Zone

The mid-water zone, with water depths between 3 and 6 m, includes the mid-layer of pelagic waters and the underlying sediments. Mid-water zones are typically found in open waters of large body creeks and river areas adjacent to channels. There is typically an increasing depth gradient moving in the direction toward the channel. These zones are always covered by water, regardless of tidal fluctuations. Submerged aquatic vegetation is absent from all but the clearest waters at these depths. Oyster and soft shell clam habitats are most common in this zone. Oyster communities support a specialized community of invertebrates, finfish and microorganisms. In the summer, finfish, crabs, and other invertebrates which would normally inhabit deeper water may be restricted to the mid-water zone by the availability of dissolved oxygen.

Mid-water zones are usually those waters that are subject to water column and sediment contamination. Currents play a large role in the distribution of contaminants in the mid-water zones. Stormwater runoff from upland areas can result in the transport of contaminated water and terrigenous soils capable of impacting the mid-water zones. Tidal waters may also serve to redistribute contaminated water and sediments from so-called "hot spots" in the Elizabeth River to areas of lesser contamination where suitable fish and wildlife activity may currently exist.

Deep Water Zone

The deep water zones of the Elizabeth River are usually the natural or navigational channels. Navigational channels are usually subject to extensive dredging to accommodate shipping traffic and associated turbulence. The combination of man-made turbulence and the natural seasonal depletion of dissolved oxygen levels does not permit channel environments to be utilized by migratory fish and wildlife species other than for movement corridors. The deep water zone within the Elizabeth River is usually devoid of benthic life that would otherwise be found elsewhere in other deep water zones of the Chesapeake Bay.

Deep water zones within military complexes and other industrial activities are subject to the influences of both point and non-point source pollution. Ship propeller and wake turbulence, in addition to natural tidal movements, result in the distribution of water and sediment contaminants away from the immediate area. Nearby fish and wildlife habitats are at risk as a direct consequence of the contaminant transport and redistribution.

Wetland Habitats

Submerged aquatic vegetation (SAV) and tidal wetlands constitute a major functional resource for fish and wildlife ecology. Although tidal wetlands are more dominant in the Elizabeth River, SAVs are an important Chesapeake Bay resource.

Submerged Aquatic Vegetation

Submerged aquatic vegetation (SAV) is one of the Chesapeake Bay's most significant natural resources. In 1976, the decline of SAV was selected as one of the three major Bay problems (the only one directly focused on living resources) to be further researched. Since that time, SAV has remained at the forefront of public consciousness. It provides food and habitat for fish, numerous other aquatic organisms, and waterfowl. SAV remains a visible indicator of good water quality and the general ecological health of the Chesapeake Bay.

Several of the key species identified for detailed analysis in this effort require SAV (directly or indirectly) for food and/or habitat. Plants such as eelgrass (a common SAV species in mid to high salinity regions) and emergent marsh grasses are major sources of primary productivity in the shallow waters of the Bay. In addition to being a direct food source for some consumers, organic detritus produced by decomposition of plant material provides food for other primary consumers such as small crabs, shrimp, selected fish and other detritivores.

Associations between SAV and finfish, shellfish, and waterfowl are well documented. The most important waterfowl wintering areas have been the most abundantly vegetated. Fish abundance in SAV communities in the upper Bay is high, indicating the importance of SAV for food and shelter. Lower Bay SAV beds serve as a primary blue crab nursery, sheltering large numbers of juvenile blue crabs throughout the year. Because prey organisms use SAV habitats, predators may be attracted to the beds. Adult fish, such as striped bass and bluefish, may hunt invertebrate prey in SAV beds. Summer resident wading and shore birds seek prey in or near SAV beds.

SAV also functions as an important stabilizer for sediments. As turbid water circulates through SAV beds, sediments tend to settle out, resulting in clearer water and increased light transmittance. Direct uptake of nitrogen and phosphorus by SAV and its associated epiphytes also serves to buffer nutrient levels in the water during the spring and summer growing season. Decomposition of SAV releases nutrients back to the water column during the fall and winter when water column nutrient concentrations are lower. SAVs can be exposed to water and sediment contaminants that are transported by tidal action from contaminated sites. Chemicals with phytoxic (i.e., herbicidal) properties are a potential concern for habitat alteration. Without vigorous vegetative support, fish and wildlife quality declines.

Tidal Wetlands

The abundance of food and shelter provided by marsh grasses ensures a very favorable habitat for other members of this community. Examples of major marsh grasses include the saltmarsh cordgrass (*Spartina alterniflora*) and the common reed (*Phragmites australis*). A host of invertebrates feed on decomposed plant material and, in turn, provide food for numerous species of higher animals. Another source of food is the dense layer of bacteria, algae, and microscopic animals that coats the stems of marsh plants. Decomposing plants and, to a lesser extent, dead animals are major food sources for the marsh dwellers. Therefore, the primary food web in the marsh environment is based on detritus. Tidal marshes are also important as physical habitat for estuarine species.

Salinity and frequency of tidal flooding are the most important factors in determining the types of plant and animal populations that inhabit a particular marsh. Freshwater marsh vegetation includes cattails, reeds, arrowarum, big cordgrass, wild rice, three-square, tearthumb and pickerel weed. Salt marshes of the mid and lower Bay are dominated by salt meadow cordgrass, saltgrass, and saltmarsh cordgrass. Irregularly flooded salt marshes have the fewest plant species and are dominated by needlerush.

Indigenous Fish and Wildlife Species of the Watershed

The Elizabeth River plays host to a variety of nonendangered and endangered fish and wildlife species that utilize the marine and terrestrial habitats of the lower Chesapeake Bay. Some species are year round residents while the majority are mostly seasonal in occurrence. The value of the Chesapeake Bay as a nursery and development ground is well known. The risk of exposure to Elizabeth River contaminants and habitat alteration is becoming a concern as a result. A general discussion of the major classes of biological organisms which can be found in the Elizabeth River watershed follows.

Fish and wildlife species within the Elizabeth River ecosystem are more at risk to chronic, sublethal exposure to contaminants as opposed to acute lethal exposure. There has been limited research on chronic exposure to toxic contaminants found in the Elizabeth River to fish and wildlife species. Table 1.1 provides a brief summary of marine organism chronic toxicity symptoms

encountered with contaminated Elizabeth River sediments, primarily polycyclic aromatic hydrocarbon (PAH) contaminated sediments. Existing data is too limited to determine the extent that toxic contaminants found in the Elizabeth River are impacting avian, reptilian, mammalian, and amphibian species, including rare, threatened, and endangered species. A list of species that are considered protected, threatened or endangered by federal and state laws and are known to inhabit the lower Chesapeake Bay are provided in Table 1.3.

Phytoplankton and Bacteria

Phytoplankton are microscopic, usually single-celled plants, representing several divisions of algae. They constitute the base of the food chain; the major primary producers in Chesapeake Bay. Thus, phytoplankton play a fundamental role in the structure of the ecosystem. They are the major food source for a number of species including zooplankton, benthic suspension feeders, and fish. Bacteria are single-celled organisms that are responsible for tremendous amounts of carbon and nutrient-cycling processes. As part of the detritus food chain, their role in decomposition of organic matter, particularly dead plankton cells, is a major causative factor of anoxia in bottom waters of the Bay.

In the surface waters of the Bay, dissolved nutrients and sunlight are taken up by these photosynthetic organisms. Factors which control fluctuations in phytoplankton numbers, composition, and production are critical to the success or failure of higher trophic levels. The balance among photosynthesis, nutrient exchange and predation ultimately determines planktonic species composition. Large changes in nutrient and toxic loadings can also cause changes in the quantity and quality (size and species composition) of plankton communities in the system. There is growing evidence that a combination of factors, probably arising from the synergistic effect of point and nonpoint source discharges of toxics and nutrients, are causing a shift in species composition. This shift is reflected in high production of bacteria and minute phytoplankton species (favoring microzooplankton production) and may be related to reduced population numbers in the higher trophic levels of the system. Oysters, for example, may grow more slowly in areas where nutrient enrichment has shifted phytoplankton species composition to smaller species which are not suitable as food. The tidal actions of the lower Chesapeake Bay replenishes the plankton supplies of the Elizabeth River. However, there is insufficient information to determine the effects of water column contaminants on planktonic populations within the Elizabeth River where flushing rates are low.

Zooplankton

Zooplankton are swimming or floating animals that range from microscopic to jellyfish size. Many are important food for fish and other organisms. For example, endangered sea turtle species feed on jellyfish. Zooplankton represent important primary consumers in the Chesapeake Bay food web, and thus function as a key link in the transfer of energy derived from phytoplankton, bacteria and detritus to higher trophic levels. Some zooplankton, particularly the mesozooplankton (medium-size), function as important and often

critical links by supplying food to larval stages of many fish and shellfish species in higher trophic levels. The distribution of mesozooplankton and the phytoplankton upon which they feed is a function of salinity.

Jellyfish, including etenophores (comb jellies) and sea nettles, prey on the smaller zooplankton and many influence summer planktonic populations and distributions. Microzooplankton, which are mostly single-celled protozoa, feed heavily on bacteria. The larvae of benthic animals and finfish are also considered to be zooplankton. These larvae prey on smaller forms of plankton and may be consumed by larger animals. As the larvae develop, they may in turn consume other zooplankton.

Zooplankton populations experience shifts in composition when exposed to contaminants. Where nutrients elevate phytoplankton populations, herbivorous zooplankton population become dominant. When water column contaminants exert stress on zooplankton populations, reproductive success and survival are minimized or reduced. Without adequate zooplankton quantity, the growth of foraging finfish can be impacted. The tidal actions of the lower Chesapeake Bay replenishes the Elizabeth River zooplankton populations. However, there is insufficient information available to determine possible effects on zooplankton populations within the low flushing areas of the Elizabeth River.

Benthos (Bottom-Dwelling)

The Chesapeake Bay supports an active community of organisms which live in association with bottom sediments or attached to solid substrate such as oyster shells, pilings, rocks, and shoreline structures. This assemblage, collectively known as the benthos, represents a major component of the Bay ecosystem. The benthos forms an important link between primary producers and higher trophic levels. Many benthic organisms are principal food sources for fish, waterfowl and crabs, while others are of direct economic importance (crabs, clams, oysters). Benthic organisms also play a significant role in the detrital pathway, breaking down organic matter. These decomposers are responsible for many key benthic processes, including nutrient recycling, sediment chemistry, and the depletion of dissolved oxygen.

The temporal and spatial distribution of benthic communities is determined primarily by chemical and physical factors (mainly salinity, depth, substrate, dissolved oxygen concentration, and temperature). The distribution and abundance of organisms composing benthic communities are, therefore, likely to respond to changes in water and sediment quality. Many benthic organisms live for 1-2 years or longer so that benthic communities are excellent indicators of an area's short and long-term trends in environmental quality. In addition, because benthic organisms past the larval stage are relatively immobile, they often complete much of their life cycles within well-defined regions of the Bay. As a result, benthic responses to changes in habitat quality are likely to be region-specific. As important intermediate links in the Bay's food web, benthic community responses to habitat changes are also likely to be representative of the responses of other living resources.

Benthic organisms are impacted by both water and sediment contaminants. Immobile filter-feeding organisms, such as oysters, remove water

borne contaminants from the water column and often bioaccumulate the contaminants in their tissue. Alternately, they can uptake, metabolize and convert contaminants into more toxic forms. Mobile species, such as blue crabs, have shown that commercially important fisheries can be challenged by contaminants, as demonstrated by tissue burdens of polycyclic aromatic hydrocarbons (PAHs) in the Elizabeth River.

Finfish

Finfish represent the majority of Chesapeake Bay nekton species. The trophic relationships of fish are diverse, depending on developmental stage, life histories, or physiological adaptations of different species. Most of the large fish species of the Bay like bluefish, striped bass, and sea trout, are temporary residents, living in the Bay for part of the year or only during certain stages of their life cycles to spawn or feed. Resident finfish, such as bay anchovies, hogchokers, and white perch, tend to be smaller in size. The spawning behaviors of Chesapeake Bay finfish place them into two main categories: ocean-spawning fish (spot, croaker, menhaden) and freshwater or estuarine-spawning fish (striped bass, herrings, shad).

Finfish occupy different trophic levels at specific stages of their lives. Most finfish initially feed on zooplankton and later turn to larger prey. The highest rates of survival of larval stages have been shown to correlate positively with the highest zooplankton densities. Thus, the success of species using the Bay as nursery grounds in its early life stages is dependent on the availability of certain types of plankton.

Finfish are represented by all consumer levels within the Bay's food web. Primary consumers, such as abundant schools of plankton-feeding menhaden, represent a major pathway from the primary producers directly to harvestable resources. Bluefish and striped bass are secondary or tertiary consumers, feeding on smaller finfish. Finfish also serve as prey for other consumer-level species. The diets of many invertebrates, waterfowl, and some mammals are composed largely of fish.

Migratory finfish utilizing the Elizabeth River ecosystem have demonstrated toxicity problems associated with contaminated sediments. Finfish samples from the Southern Branch Elizabeth River have exhibited health problems (e.g. eye lens cataracts, lesions, fin rot) that warrants further investigation.

Waterfowl and Upland Birds

In addition to the Chesapeake Bay's importance as a source of valuable finfish and shellfish resources, the marshes and woodlands surrounding the Bay provide habitat for a variety of waterfowl, birds and other vertebrates.The Chesapeake Bay is part of an important migratory path known as the Atlantic flyway. Most of the waterfowl reared between the western shore of Hudson Bay and Greenland spend some time in the marshes and on the waters of the Chesapeake Bay during their migrations.

Like finfish, bird species occupy all consumer levels of the food web. Some birds feed on primary consumers (such as mollusks), while other species feed on primary producers (plants). Birds feeding on secondary consumers, such

as fish, are considered tertiary consumers; at the extreme edge of the food web, these high-level consumers (e.g. bald eagles) are often the first to be affected by disruption of the ecological integrity of the Bay. There is insufficient information available to characterize the risk of avian populations from Elizabeth River contaminants.

Mammals

Within the lower Chesapeake Bay ecosystems, terrestrial and marine mammals are frequently observed. Muskrats are year-round residents in Elizabeth River tidal wetlands. In fresh water drainages from the Dismal Swamp into the Elizabeth River, beavers are also considered permanent residents. Porpoises and whales are representative marine mammals that occur in the lower Chesapeake Bay on a seasonal basis. Porpoises, commonly referred to as dolphins, are an occasional to common sight in the Elizabeth River. In 1987-88, dolphin populations experienced massive mortalities in the lower Chesapeake Bay and off the Virginia coast. Although the cause was attributed to bacterial infection, measurements of chemical contaminants in body tissues leaves open the question of possible contribution of the Elizabeth River to this event. There is insufficient information available to characterize the risk of marine mammals to Elizabeth River contaminated food resources.

Endangered Species

Table 1.2 is a listing of rare, protected and endangered species known to occur in the lower Chesapeake Bay ecosystem, including the Elizabeth River Watershed. There is insufficient information available to determine any potential risk to such species from Elizabeth River contaminants. Many of these species are associated with somewhat suitable fish and wildlife habitats within the Elizabeth River Watershed. The history of contaminants and endangered species justifies a closer look to examine the potential for exposure to Elizabeth River contaminants. For example, the piscivorous (i.e. fish-eating) habits of raptors (e.g. eagles, ospreys) and their presence within the Elizabeth River Watershed provides an opportunity for contaminant exposure.

Table 1.1
Elizabeth River Fish and Wildlife Contaminant Pathology Research Findings

Species	Observations	Results
Spot (Hargis, W.J., et al., 1984; Roberts, M.H., et al., 1989)	Healthy fish exposed to PAH contaminated sediments in laboratory systems.	(1) Fin and gill erosion (2) Integutmental lesions (3) Pancreatic and liver alterations (4) Reduced hemocrits (5) Mortalities
Spot, Hogchokers (Weeks, B.A., et al., 1986; Weeks, B.A. and J.E. Warriner, 1984; Warriner, J.E., et al., 1988)	Immune system measurements of species collected in areas contaminated with PAHs.	Macrophage phagocytosis (immune system function) reduction; reversal upon exposure to uncontaminated water.
Oysters (Huggett, R.J., et al., 1987)	Healthy specimens transplanted in the Elizabeth River.	Rapid PAH uptake (bioaccumulation)
Hogchokers, Toadfishes, Spot, Croaker, Weakfish (Bender, M.E., et al., 1988; Hargis, W.J. and D.E. Zwerner, 1988)	Health condition of field collected fish in PAH contaminated areas. Laboratory exposure to water from PAH contaminated sediments.	(1) Fin erosion (2) Eye lens cataracts (spot, croaker, weakfish) (3) Skin ulcerations
Spot (Roberts, M.H., et al., 1987; Van Peld, P.A., et al., 1990)	Metabolism of PAH in juvenile fish collected in PAH contaminated areas.	Higher metabolic enzyme levels resulting in increase of toxic oxidation products.
Mummichog (Vogelbein, W.K., et al., 1990)	Physiological condition of fish collected in areas of PAH contamination.	(1) Hepatic lesions (2) Hepatocellular carcinomas
Grass shrimp, Copepads, Polychaetes (Hall, L.W.,Jr., et al., 1991)	Laboratory exposure to contaminated water and sediments.	(1) Survival reductions in grass shrimp and copepods after exposure to ambient water. (2) 100% mortality in sediment tests using all three species.
Muskrat (Halbrook, R.S., 1990)	Health condition of field collected specimens	(1) Nickel and selenium suspected in reduced body and spleen weight. (2) PAH and metals in tissues (3) DNA adduct detection (formed from exposure to carcinogens)
Atlantic Bottlenose Dolphins (Kuehl, D.W., et al., 1991)	Field collections of tissues of Virginia populations	Tissues contaminated with DDE, dieldrin and PCBs. Insufficient evidence to determine impacts from the Elizabeth River.

Table 1.2
Rare, Protected or Endangered Species Known to Frequent the Lower Chesapeake Bay (Including the Elizabeth River Watershed) (Priest, J., 1995; Zylstra, S., 1995)

Species	Federal Status	Virginia Status
Fish		
Shortnose sturgeon	Endangered	Endangered
Atlantic sturgeon		Threatened
Inverebrates		
Tidewater interstitial amphipod	Species of Concern	
Herpetofauna		
Atlantic loggerhead	Threatened	Endangered
Atlantic green turtle	Threatened	Endangered
Kemp's ridely turtle	Threatened	Endangered
Atlantic leatherback	Threatened	Endangered
Dwarf waterdog		Undetermined
Greater siren		Undetermined
Northern diamondback terrapin	Species of Concern	
Birds		
Bald eagle	Threatened	
American peregrine falcon	Endangered	
Arctic peregrine falcon	Threatened	
Red-cockaded woodpecker	Endangered	
Loggerhead strike	Candidate	
Great blue heron		Species of Concern
Little blue heron		Species of Concern
Great egret		Species of Concern
Black-crowned night heron		Species of Concern
Yellow-crowned night heron		Species of Concern
Least bittern		Undetermined
American bittern		Undetermined
Glossy ibis		Species of Concern
Sharp-shinned hawk		Threatened
Cooper's hawk		Undetermined
Red-shouldered hawk		Species of Concern
Osprey		Threatened
American kestrel		Threatened
Common moorhen		Undetermined
Piping plover	Threatened	Threatened
Wilson's plover		Threatened
Upland sandpiper		Threatened
Gull-billed tern		Threatened
Forster's tern		Species of Concern
Least tern		Species of Concern

Sources of Toxics: A Comparison of Point Source and Stormwater Input

Synopsis of a key finding from a source identification performed by URS Consultants, 1995, as a background report for the Toxics Reduction Team of the Watershed Action Team. URS identified sources of toxic inputs to the Elizabeth River and Willoughby Bay, including estimated amounts from permitted facilities (point sources) and from stormwater runoff (non-point sources). Full report is available separately.

Heavy Metals

The combined total metals loading to the Elizabeth River from point sources and stormwater runoff was estimated to exceed 100,000 lbs/year. Approximately 12 percent of the load is from point sources, whereas 88 percent of the load is a result of stormwater runoff. A few branches of the river experience situations where point source metals loadings exceed those due to stormwater runoff. There are only four river segments where point source loads exceed stormwater loads.

Figure 1 compares the point source and stormwater total metals loadings in each branch of the Elizabeth River. This figure shows that by comparison, the Main Branch (EL), the Western Branch (WB), and the Lafayette River (LF) receive the lowest combined total loads. The Southern Branch (SB) receives the highest total metals loading in the river due to the high degree of imperviousness and the numerous industrial point sources located within the branch. The Eastern Branch (EB), ranked second highest in total metals load, is significantly impacted by stormwater.

Polynuclear Aromatic Hydrocarbons

The combined PAH loading to the Elizabeth River from point sources and stormwater runoff is estimated to exceed 1 million lbs/year. Less than 1 percent of the PAH load can be attributed to permitted point sources, while more than 99 percent is estimated to be the result of urban stormwater runoff.

Figure 2 compares the point source and stormwater total PAH loadings in each branch of the Elizabeth River. Note that essentially all of the PAHs currently entering the Elizabeth River originate as stormwater runoff. Figure 2 also indicates that the Main Branch (EL), the Western Branch (WB), and the Lafayette River (LF) receive the lowest inputs of PAHs. This is not surprising since the land use within the drainage areas of the Western Branch and the Lafayette River

consist primarily of residential areas. The highest loadings of PAHs are to the Southern Branch (SB) and Eastern Branch (EB) of the Elizabeth River where commercial and industrial land use is highly concentrated. It is important to note that the total PAH load to the river is more than ten times the total metals load, since PAHs account for 15 of the 20 top ranked pollutants based on the results of the contaminant ranking system described previously. Copper and zinc are the only two metals included in the top 20 contaminants of concern.

Methodology

To identify potential point and nonpoint sources responsible for contamination in the Elizabeth River watershed, links were established between the receptors (sediments, ambient water and biota) and the potential sources of the toxic inputs. One of the primary tools used to establish the link between problems in the Elizabeth River and sources of toxic inputs in the watershed involved a geographic information system (GIS). The GIS combined digital mapping of the study area with database information concerning the watershed, the distribution of problematic contaminants within various sections of the watershed, and potential point and nonpoint sources of the contaminants of concern.

The source identification of toxic inputs to the Elizabeth River included estimates of toxic loadings from permitted facilities (point sources) and from stormwater runoff (nonpoint sources). Although specific loadings were quantified for each of the individual metals and several of the polynuclear aromatic hydrocarbons (PAHs), the results are categorically presented and primarily discussed in terms of "total metals" and "total PAHs".

Although the contaminants of concern in the Elizabeth River watershed include PCBs, TBT, and DDT, it was not possible to readily quantify current loadings for these contaminants. Therefore, these toxics were not specifically evaluated in terms of current loadings from specific sources. PCBs and DDT are no longer used commercially in the United States and inputs to the river are predominately historical in nature.

Point Sources

Point sources, as defined herein, refer to the nature of the discharge origin. While a great deal of stormwater runoff enters the river via storm drains, it is considered a non-point source since its origin is areal in nature. Point sources consist principally of permitted industrial, municipal, and federal waste treatment and management facilities discharging to the river.

A database of point sources was developed for 74 permitted facilities discharging to the Elizabeth River. Discharge monitoring flow data and effluent concentrations were used to estimate the annual toxics load to the Elizabeth River for each facility. Once the loadings were calculated for the various facilities, the toxic inputs were summed for the respective river segments.

Monthly flow data were available from Discharge Monitoring Reports (DMR) compiled by the Department of Environmental Quality (DEQ) for all permitted facilities. Concentration data were available for 25 of the permitted dischargers using information collected under the DEQ Toxics Management

Program (TMP). Available TMP concentration data for facilities with the same Standard Industrial Classification (SIC) code were applied to other facilities without concentration data in that SIC code. Through this process, a total of 33 permitted point sources were assigned concentration data. Point sources having no TMP data and no facilities of similar SIC code were not assigned concentrations.

Stormwater Runoff Loadings

The major sources of toxics found in urban stormwater runoff include: compounds formed during the incomplete combustion of fossil fuels; products of metal alloy corrosion; products of automobile use; pesticides; industrial manufacturing products and raw materials; and atmospheric deposition. Land use activity, percentage of impervious surface area, rainfall patterns and intensity, density of automobile traffic, and the extent of air pollution are all factors that affect the quantity and quality of urban runoff. Pollutant loadings for over 2000 individual land areas in the watershed were developed using the methodology which follows.

Estimates of urban runoff pollutant loadings were developed using a load estimation model known as the Simple Method (Schueler, 1987). The Simple Method relates rainfall, land use, drainage area, and pollutant concentration to the annual loading. Load estimates were developed on the basis of land use categories.

The primary determinant of stormwater runoff volume is the impervious fraction of the land. Schueler (1987) empirically determined that the fraction of annual precipitation converted to stormwater runoff is a linear function of the percent imperviousness. The more intensely developed areas have the highest degree of imperviousness, and, therefore, the greatest potential for runoff-derived pollutant loadings. Without the benefit of actual measurements, impervious surface area within each drainage basin was inferred from the land use.

The event mean concentrations (EMCs) of toxic pollutants were derived from the Nationwide Urban Runoff Program (NURP) Priority Pollutant monitoring project, from a review of the literature (Olsenholler, 1991), and from regional data from National Pollutant Discharge Elimination System (NPDES) stormwater permit applications.

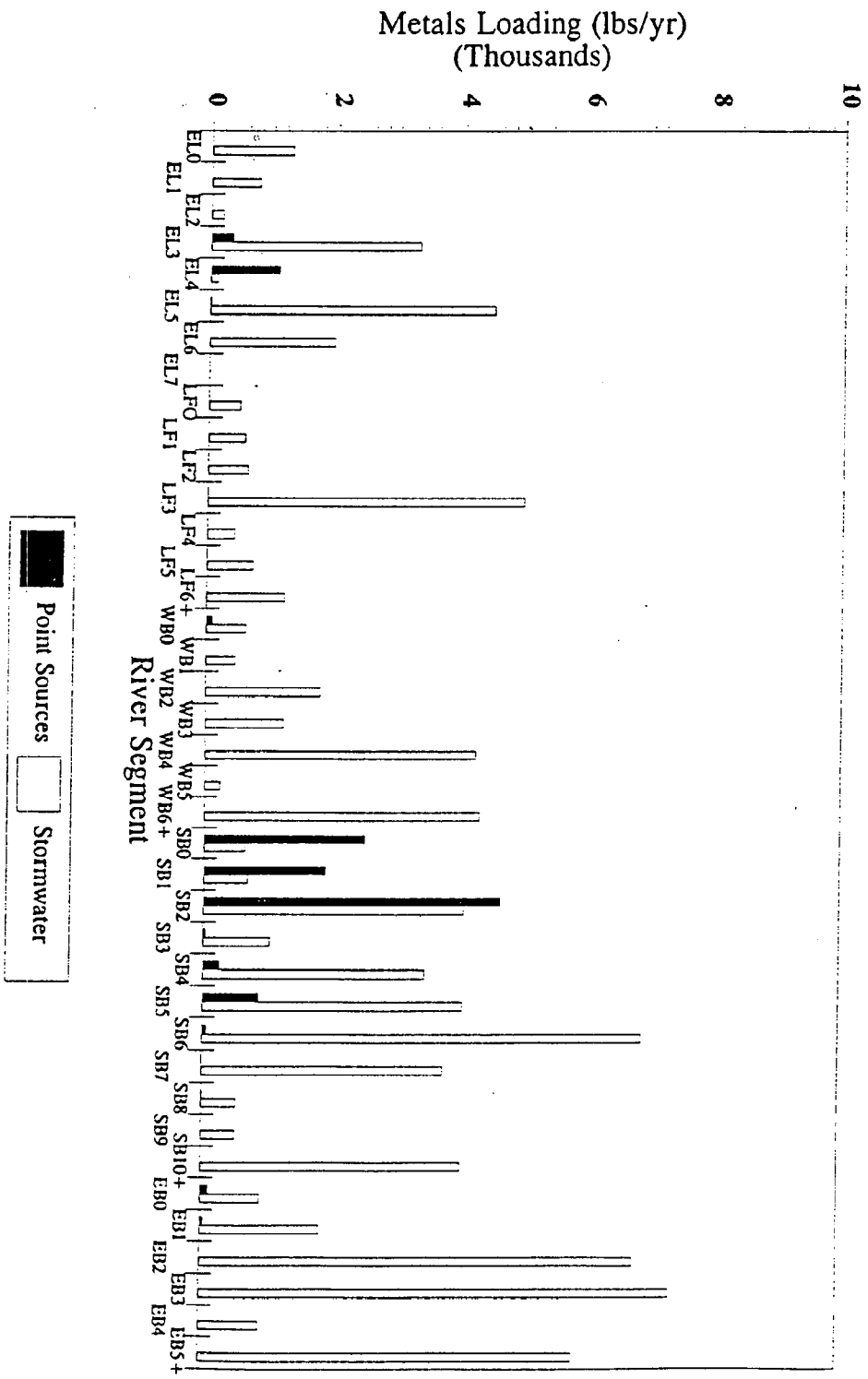
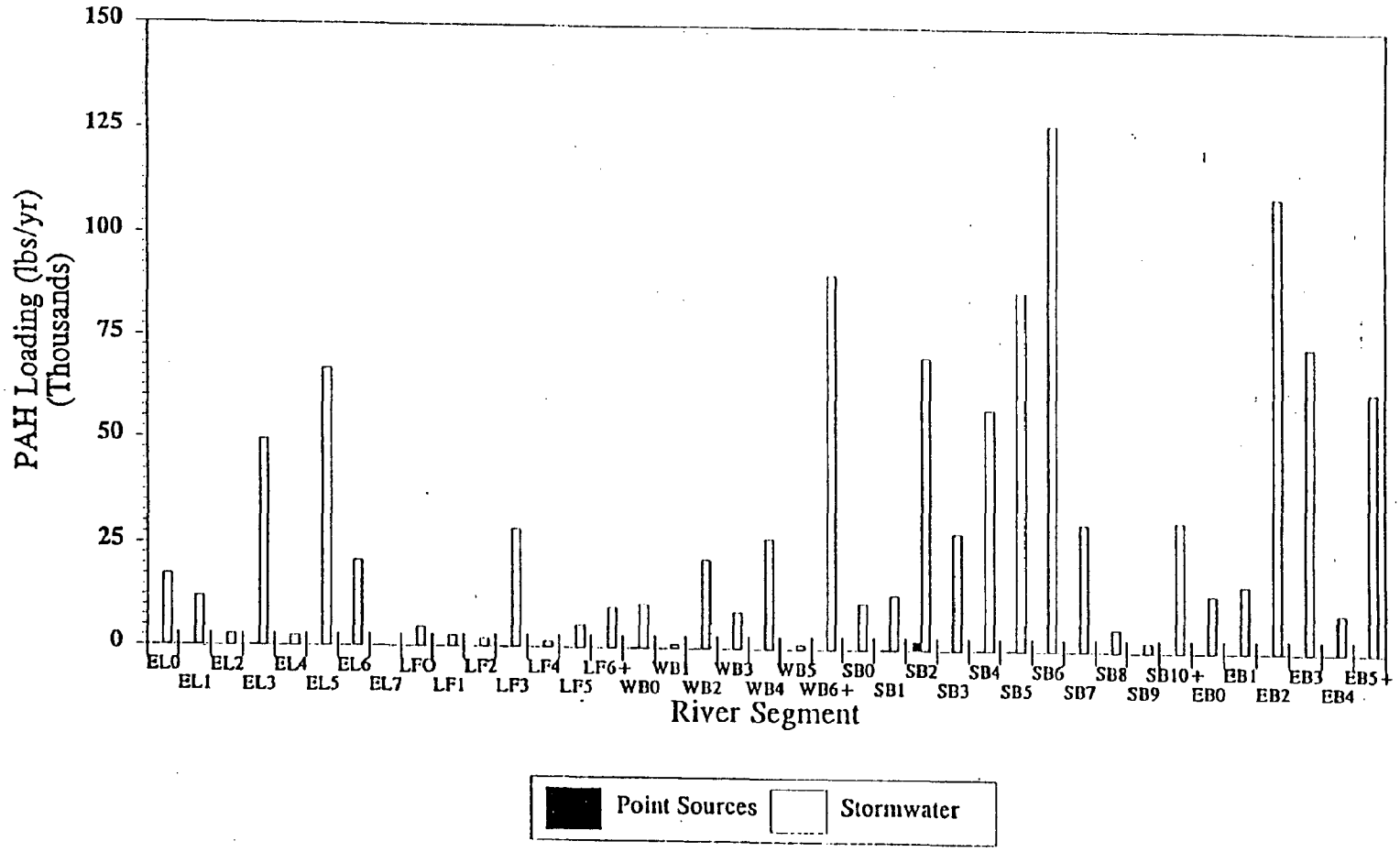
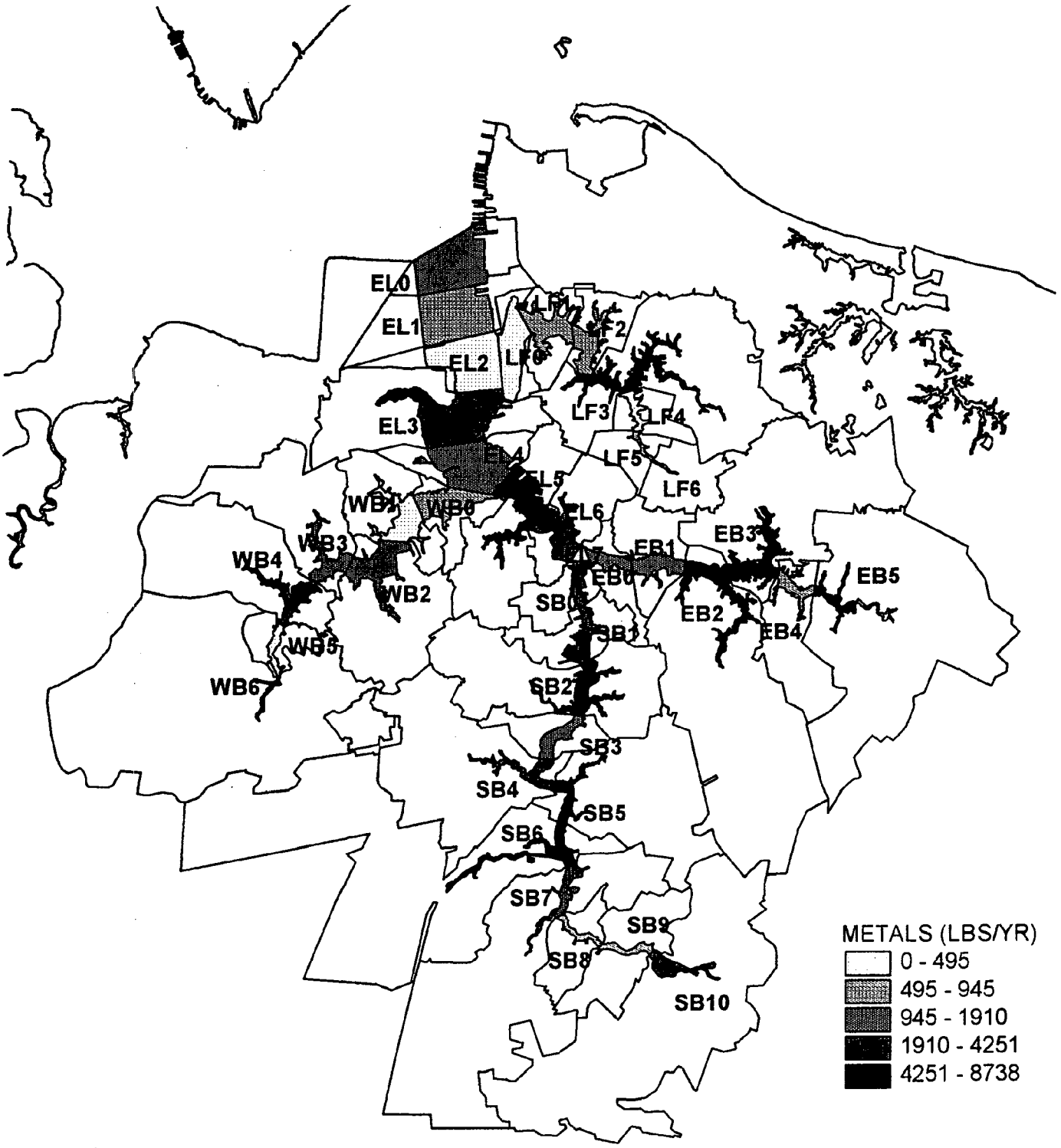


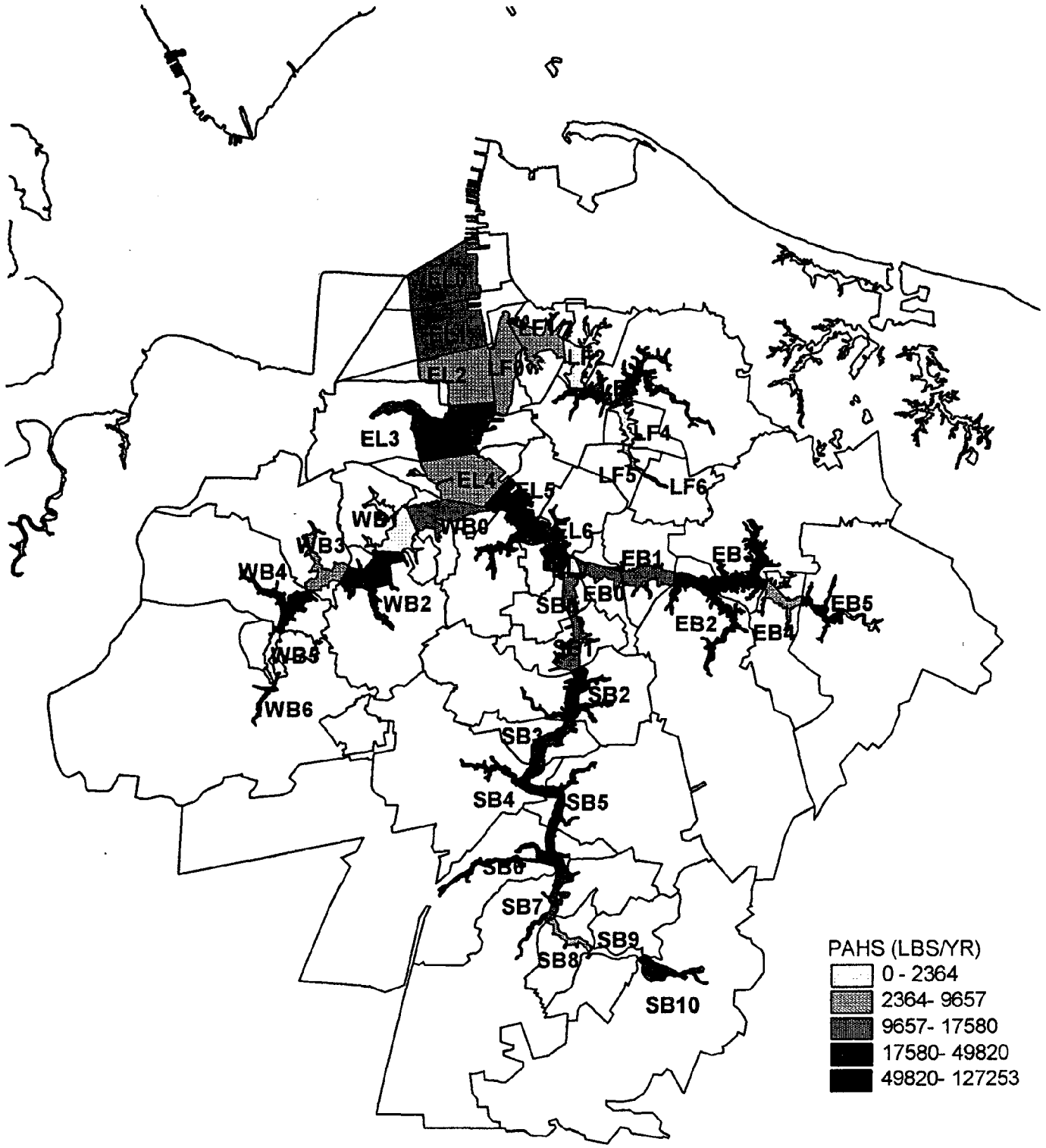
Figure 1. Total Metals Loadings (By River Segment)

Figure 2. Total PAH Loadings (By River Segment)





Total Metal Loadings (lbs/yr) from Permitted Facilities and Storm Water Run-off.



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"Structural BMP Retrofits."
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"Promoting Mass Transit and Alternate Transportation to Reduce Pollutants to the Elizabeth River: Draft Research Report."
"Removal of Abandoned Vessels and Pilings from the Elizabeth River."
"Improve Inadequate Sanitary Sewage Collection Systems."
"Enhance Compliance with Existing Regulations."
" Non-Point Source Pollution Management Option - Reduce Runoff and Erosion Before it Reaches the River."
"Sustainable Landscaping - A Management Option to Reduce Non-Point Source Pollution."
" Nutrients Task Force."
"Enforcement of Existing Regulations."
"Implementation Analysis for Items 15 and 17 of the Point Source Committee 'Laundry List'."
"Preliminary Feasibility Study of Storm Water Discharge Pretreatment from Industrial Facilities on the Elizabeth River."
"All Point Sources in the Elizabeth River Watershed Develop Pollution Prevention Plans."
"Implement Cooperative, Multi-Sector and Incentive-based Monitoring for Toxics and Nutrients in Effluent(s) and Ambient Water(s)."
" Reducing Improper Disposal and Releases from Commerical Enterprises"

Sediment Quality Task Force

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"Draft Effectiveness Evaluation, Proposed Options Regarding Craney Island Managment."

"Press Responsible Agencies to Establish Sediment Quality Criteria and Standards."
"Develop Marsh Islands Using 'Clean' Dredged Materials to Improve Water and Sediment Quality of a Waterway and Restore Habitat."
" Remediate/Remove Contaminated Sediments."
"Improve Sediment Quality at Heavily Contaminated Sites."
"Shoreline Rehabilitation."
"Identify Sources of TBT and Remediate."
" Construction of Sediment Traps at Most Effective Sites."

Habitat & Living Resources Task Force
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"Increasing Forested Areas."
"Increase Buffer Areas."
"Increase Pervious Surfaces."
"Vegetated Buffer Areas."
"Increase Wetland Acreage."
"Increase Public Access."
"Stormwater Management."

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Glossary

Alongshore Buffer Areas - Shoreline parks and walkways.
Altered Hydrology - Natural or man-made changes in the watershed that change the existing water cycle relationships (evapotranspiration, precipitation, runoff, and percolation).
Angle of Repose - Ability of sediments to maintain side slopes on an island.
Aquifer - Underground formations which allow groundwater to be stored and accessed for use. Aquifers have a variable capacity to transmit water depending upon type and size. Aquifers also allow for subsurface flow of groundwater from areas of higher pressure to lower pressure and are filled by direct infiltration of precipitation and surface water.
Atrazine - Organic compound used as a herbicide, plant growth regulator, and weed-control agent.
Baffle Wave Energy - To deflect waves to that they are dissipated and have minimal impact on the shoreline.
Benthic - Bottom-dwelling.
Benzene - Organic compound found in dry cleaning fluids, fumigants, gasoline, insecticides, motor oil, paint remover, rubber cement, solvents, and spot removers.
Best Management Practices - Recognized techniques used by industry to mitigate the effect of pollutants on the river.
Biochemical Remediation - An on-shore treatment of contaminated sediments removed from the river bottom in order to eliminate hazardous characteristics for the sediment before reuse or disposal.
Bioassays - Toxicity tests performed in order to determine the impact of various stressors upon a species representative to the ones found in the river.
Biochemical Oxygen Demand - A measure of the degradable organic compounds which serve as a food source for microorganisms.
Biodiversity - Number of different animal and plant species which are essential for an healthy environment.
Biological Uptake of Nitrates and Phosphorus - Process by which plants use nutrients to produce food
Biota and Fauna - Plants and animals.
BMP - Best Management Practice
BMP Retrofit - Structure or series of structures designed to mitigate the harmful effect of human activity and development in an urban watershed.
BOD - Biochemical Oxygen Demand
Capping - Placement of clean material over contaminated sediments to stop or slow diffusion of stressors into the water column and to prevent aquatic organisms from coming into contact with the stressors.
CBPA - Chesapeake Bay Preservation Act
Chlordane - Organic compound found in insecticides, oil emulsions, dusts, and dispersible liquids.
Composite Priority Pollutant Scans - Laboratory technique to detect all 129 priority pollutants usually performed when the source of the potentially hazardous waste is unknown.

Conventional Pollutants - Natural or man-made substances that are undesirable in that they may lead to environmental degradation, for example, BOD, TSS, oil and grease, and pH.
Cost-Benefit Ratio - Economic tool to compare the cost of a project with the benefit of the project to determine if it is cost effect to proceed with the project. A cost-benefit ration of less than 1.0 indicates that the benefits outweigh the costs.
Creosote - Oily preservative used on wooden pilings.
DDT - Acronym for an organic compound used in insecticides and pesticides.
Department of Environmental Quality - Office within the Commonwealth of Virginia that is chartered to protect the natural resources within the Commonwealth for the citizens of the Commonwealth.
DEQ - Department of Environmental Quality
Dimethylaminoethylene Dichloride - Organic compound used as a disinfectant in flow-through MSD
Dioxin - Organic compound found as an impurity in a certain herbicide.
Dissolved Phase Remediation Systems - Recommended treatment for removal of toxic pollutants. Because toxic pollutants are more toxic when dissolved in the water where they are more available for uptake and ingestion, treatment of this dissolved phase is critical for treatment of toxic pollutants.
Dredging - A construction process (mechanical, hydraulic, or pneumatic) involving the relocation of river sediments for navigational purposes.
Dry Ponds - Urban storm water runoff technique to capture runoff for stabilization and treatment prior to discharge into the river. A dry pond is designed to remain dry unless a storm event occurs.
End of Pipe or End of Ditch Treatment - Treatment technique applied at the point where the waste leaves the pipe or ditch as a point source.
ERP - Elizabeth River Project.
Estuarine Food Web - Intricate balance between primary producers such as phytoplankton and secondary producers such as zooplankton as found in the river where it joins the ocean.
Eutrophication - Process of stream degradation when a stream is rich in plant nutrients such as nitrogen and phosphorus.
Fee Simple - Title
Flow-Through Marine Sanitation Device - Treatment system aboard recreation boats that treats human sewage prior to discharge into the river.
Flux - Flow.
Formaldehyde - Organic compound used as a disinfectant in flow-through MSDs.
Geotextile - A porous fabric of synthetic fibers.
Grassy Swales - Low-lying area usually in paved areas which is used to mitigate the effects of storm water runoff.
Groins - A small jetty extending from the shoreline which protects against erosion of the shoreline; also known as groynes.
Ground Water Recharge - Infiltration into the ground water which acts to increase the level of the water table.
Habitat - Place where plants and animals live.

Heavy Metals - Metals such as cadmium, copper, lead, and zinc with an atomic number greater than 23.
Impervious Surfaces - Natural or man-made surfaces which impede the infiltration of water into the ground , for example, roads, parking lots, driveways, and roofs.
In Situ - Latin term meaning in place.
Infiltration - Process were rain water filters down through the ground into the ground water.
Intertidal - Shallow area between the low-water mark and the high-water mark.
Mean Cross-Tidal Flow - Statistical term to identify the flow of water that runs perpendicular to the tide.
Mg/Kg - Milligrams per kilogram (parts per million).
MSD - Marine Sanitation Device
Ng/L - Nanogram per liter.
Nonpoint Source - Traditionally defined as diffuse sources of pollution that are not traceable to a specific source. Storm water runoff is a typical example. Nonpoint source runoff loadings largely are a function of land use. The more intense the land use (i.e., population density, number of cars, percent pavement) the higher the concentrations of pollutants in runoff and the higher the actual volume of runoff.
NPDES - National Pollutant Discharge Elimination System.
Nutrients - Pollutants such as nitrogen and phosphorus which encourage the growth of algae. Excessive algal growth leads to depletion of oxygen in the water, which is harmful to fish and may cause odor and aesthetics problems.
Outfall Locations - End of pipe or end of ditch locations for point source discharges where NPDES permits may require sampling prior to discharge.
PAHs - Polynuclear aromatic hydrocarbons
Particulate Pollutants Natural or man-made substances that remain as a solid in the water and do not dissolve.
Pathogens - Organisms such as bacteria and viruses which cause disease.
PCB - Polychlorinated biphenyls
Percolate - Rate at which rainfall filters into the ground; usually measured as inches per minute.
Phytoplankton Assemblages - Microscopic plants that serve as a major food source for zooplankton, bottom dwellers, and young fishes. Phytoplankton are major sources of photosynthesis.
Point Source - Discharge carried into the river via pipes and ditches. Unlike nonpoint sources, the origin of the point source discharges are traceable to a single site or process.
Pollution Prevention - Any effort to reduce the quantity of industrial, hazardous, or toxic waste through changes in the waste generating or production process at the source: reduce, reuse, recycle.
Polychlorinated Biphenyl's - Organic compound found in heat-exchange and insulating fluids. Manufacture of PCBs was discontinued in the US in 1976.
Polynuclear Aromatic Hydrocarbons - Fossil fuel based combustion products and by-products.

Pore Water - Water that is found in the microscopic spaces between the sediment particles.
Priority Pollutant - One of 129 natural or man-made pollutants listed in one of six major categories: volatile organics, acid-extractable organics, base and neutral organics, pesticides and PCBs, metals, cyanides, and asbestos which are used to identify materials as hazardous materials.
Quanternary Ammonium - Inorganic compound used as a disinfectant, cleanser, and sterilizer in flow-through MSDs.
Rain Gardens - New concept for alternative storm water management combining grasses, shrubs, and trees to simulate a forest environment. This usually is done at the low point of a developed lot.
Resource Management Area - RPA designated by individual locations for management of natural resources.
Resource Protection Area - Includes tidal wetlands, tidal shores, nontidal wetlands connected by surface flow and contiguous to tidal wetlands or tributary streams.
Riparian Areas - The river bank.
Riprap - Broken stones or masonry.
Riprap Revetments - Riprap used to mitigate the effect of tides or propeller wash.
RMA - Resource Management Area
RPA - Resource Protection Area
SAV - Submerged aquatic vegetation
Sediment - Organic and mineral matter that settles in the bottom of the river.
Sedimentation - A natural process in estuarine ecosystesm whereby particulates settle in the bottom of the river. Its magnitude and impact is affected directly by human activities such as filling of tidal creeks and marshes, straightening and bulkheading of channels, and dredging of navigation channels.
Sheet Flow - Excess rainfall that does not infiltrate into the ground flows in a thin sheet; also known as overland flow.
Shoal Areas - Shallow areas.
Siltation - Act of of filling in the river bottom with silt such as organic matter and sand.
Soluble Pollutants - Natural or man-made substances which dissolve in water.
Storm Water Runoff - Water that does not infiltrate into the ground during a rain event but flows into surface waters such as the river.
Stressors - Natural or man-made substances such as heavy metals, BOD, pathogens, and pesticides which impact the quality of the river.
Submerged Aquatic Vegetation - Includes all underwater plants. SAV serve as food sources, cover, and spawning areas for many species in the river.
Surgical Hydraulic Dredging - Dredging done with an hydraulic dredge in order that the least amount of area be disturbed.
Suspended Solids - Particulates that remain in the water and do not settle out or dissolve.
Switchgrass
Synergistic Effect - Occurs when the outcome is greater that the sum of inputs.
TBT - Tributyltin

TMDL - Total daily maximum load
Toluene - Organic compound found in gasoline, solvents, resins, most oil, rubber, and saccharin.
Total Daily Maximum Load - Amount of a pollutant that can be assimilated by the receiving stream and can be predicted not to cause an exceedance of a particular water quality standard.
Total Suspended Solids - Laboratory technique to detected suspended solids.
Toxic Pollutants - Natural or man-made substances that are undesirable in that they may lead to environmental degradation because of their effects on marine life even at low levels: example, heavy metals, organic compounds, and pesticides.
Tributyltin - Paint antifoulant used in on boat hulls.
TSS - Total suspended solids.
Turbidity - A measure of the amount of suspended solids in the water which makes the water appear cloudy.
Ug/L - Micrograms per liter.
Ultra-Urban BMPs - Techniques used in urban areas that are extensively developed.
USEPA - United States Environmental Protection Agency.
Vegetated Buffer Areas - Zone of natural, undeveloped land managed to lessen the impact of adjacent land use and practice on water quality and usually is considered to be adjacent to shoreline within 100 feet.
Virginia Pollutant Discharge Elimination System - Regulation of the NPDES in the Commonwealth of Virginia by the DEQ.
WAT - Watershed Action Team of the Elizabeth Rive Project
Water Column - Scientific technique to examine river water as viewed as a single column of water rather than as the entire river.
Watershed - Surface land area within which all precipitation moves toward internal drainage pathways such as streams, rivers, estuaries, and the ocean. A watershed also is called the drainage basin. All rain and snow falling within the watershed moves toward the river due to the topographic slope of the ground.
Win-Win - A management tool by which all interested parties come to consensus on their objectives.
Xeriscaping - A water conservation technique using water-wise landscaping.
Xylene - Organic compound found in gasoline, solvents, adhesives, and rubber cement.
Zooplankton Assemblages - Small animals such as crustaceans which feed upon the phytoplankton and are the most important food source for secondary producers such as fishes.

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HAVING THEIR PHIL/C1

The Virginian-Pilot

AY
21, 1996

SERVING SOUTHEASTERN VIRGINIA AND NORTHEASTERN NORTH CAROLINA 131st Year, No. 214

Plan is born to save Elizabeth River

iling Nauticus works its budget make ends meet

itors, revenue are in short supply.

EX MARSHALL
WRITER

the second year in a Nauticus is bringing ver people and less than it did in its us season.

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pite being open dur- nter months for the ime this year, the ship-gray building ome up at least

"I think this place is going to work, but it's not going to happen

plement payments on $35 million in bonds sold to build the attraction. It also applies the taxes Nauticus pays to Norfolk — roughly $500,000 annually — to the debt payments instead of the city treasury.

David T. Guernsey, Nauticus's president since January, said Thursday that the key to turning the facility around is getting citizens to appreciate the attraction more.

"I think this place is going to work, but it's not going to happen overnight," Guernsey said.

HIGHLIGHTS

Critical needs identified by the Elizabeth River Project watershed action team:

- **Reduce sediment contamination.**
- **Increase wetlands, vegetated buffers and forested areas.**

Unlikely group worked 4 years on voluntary ways to ease pollution.

BY SCOTT HARPER
STAFF WRITER

NORFOLK — After four years of debate and negotiation, an unlikely coalition of citizens, business executives, naval officers and environmentalists released a plan Thursday to begin cleaning up the desperately polluted Elizabeth River.

The 18-point plan written by the Elizabeth River Project sets broad, voluntary goals through 2010 to revive the historic waterway, which has helped define Hampton Roads as an international port and indus-

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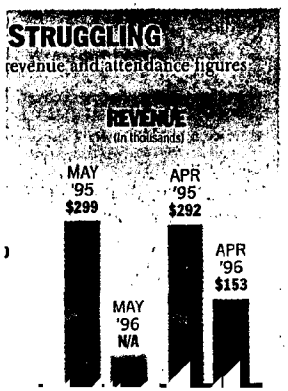
"I think this place is going to work, but it's not going to happen overnight," Guernsey said.

The center has reduced prices for an all-encompassing ticket from $14 to $10.95. That meant, however, eliminating a $7.50 general admission ticket that did not include some of the most popular attractions.

Nauticus has pushed to sell annual memberships, something other museums, zoos and science centers around the country have found important.

Please see **Nauticus,** *Page* **A8**

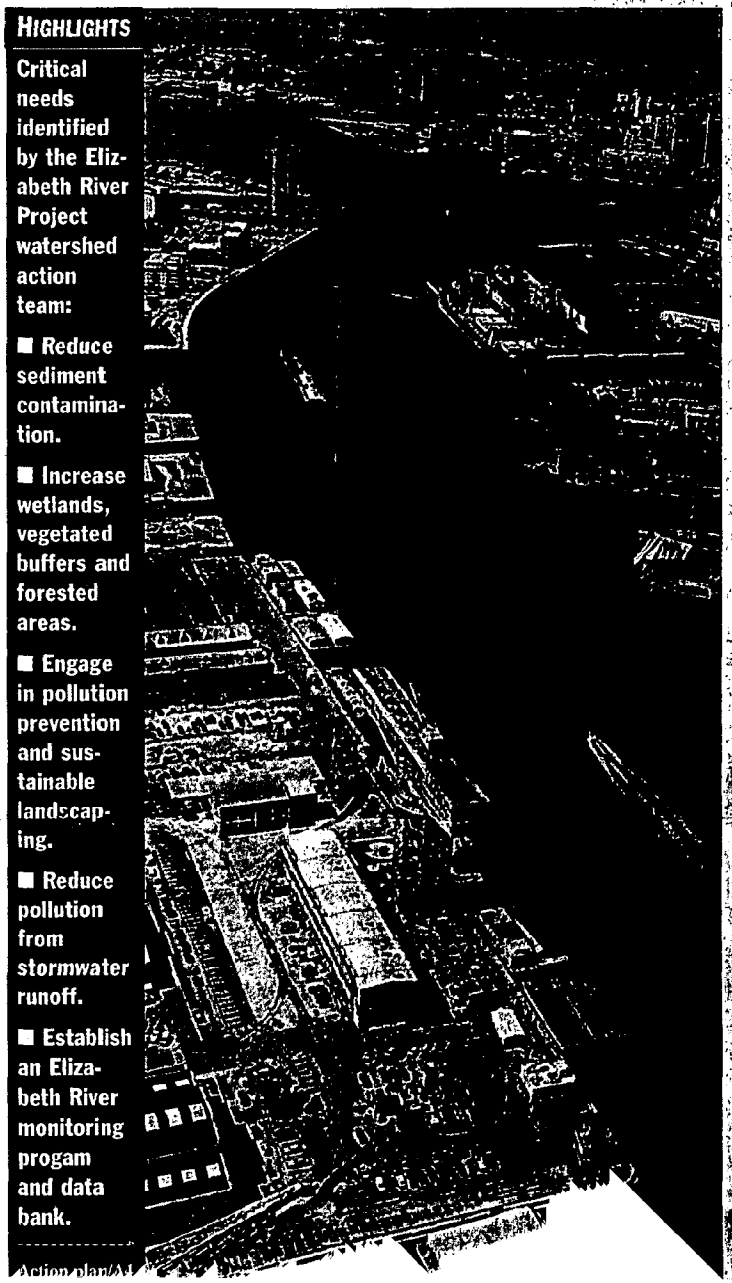


HIGHLIGHTS

Critical needs identified by the Elizabeth River Project watershed action team:

- **Reduce sediment contamination.**
- **Increase wetlands, vegetated buffers and forested areas.**
- **Engage in pollution prevention and sustainable landscaping.**
- **Reduce pollution from stormwater runoff.**
- **Establish an Elizabeth River monitoring progam and data bank.**

Action plan/A4



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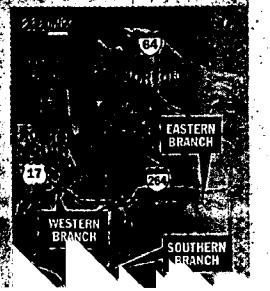
The 18-point plan written by the Elizabeth River Project sets broad, voluntary goals through 2010 to revive the historic waterway, which has helped define Hampton Roads as an international port and industrial center.

The plan was sealed with the signing of a "Declaration of Interdependence" by several local mayors, civic leaders, corporate executives, state government officials, Navy and Army officers. It pledges future support and resources for the restoration efforts in the future.

Without the threat of government regulation or penalty, the plan asks for civic-minded action from people and interests across the political spectrum — to reduce new pollution flows, replant forests and wetlands, curb dirty runoff from homes and development, expand environmental education, and purge intensely toxic wastes trapped in river sediments.

Please see **River,** *Page* **A4**



generator and a Navy shipyard that works on nuclear-powered warships.

Shellfish harvesting has been banned since 1925 because of thick pollution. And swimming in much of the Elizabeth is considered a health risk, especially in the highly industrialized Eastern and Southern branches.

But one of the more eye-opening revelations from research conducted in preparing the plan is that stormwater runoff — from streets, lawns, storm drains and parking lots — is as much to blame as any smoke-breathing factory.

"I think a lot of people came into this with some preconceived notions about what's killing the river," said Mike Host, head of the environmental division at the Norfolk Naval Shipyard. "But a lot of the big industries, the big sources, are highly regulated already.

"So I think a lot of people came away with a better understanding that probably what we put on our front lawns is causing much of the problem now," Host said.

To wit: More than 500,000 people live within the Elizabeth's 300-square-mile watershed, contributing millions of gallons of sewage to the river, plus pesticides and fertilizers from lawns and gardens, and oily runoff from streets and parking lots.

While progress has been made in recent years — sea birds are back in greater numbers and dolphins can be seen swimming inside the river again, for example — much remains to be done.

Project leaders say they have few illusions about restoring the Elizabeth to its original form, as first viewed by English explorers in the 17th century — a wide, lush and wild tidal basin teeming with fish and shellfish.

To turn the clock back that far would require stripping the river of its dense industrial and commercial development, which also happens to be the economic lifeblood of South Hampton Roads.

Instead, the project seeks to instill respect and sensitivity for the river as a natural system, and to restore its decimated ecology in a gentle, gradual way that does not strangle economic growth, explained Marjorie Mayfield, a former journalist who now coordinates the Elizabeth River Project.

As has been the hallmark of the grass-roots project since its humble beginnings around a kitchen table in 1991, cooperation and consensus are at the heart of the plan.

Government agencies, which traditionally have spearheaded such cleanup campaigns elsewhere, are involved here more in the background, offering technical advice, grant money and research.

The move was intentional, Mayfield said, in order to encourage all parties into the negotiations and to promote what she described as "a bottom-up approach" to solving a community problem.

Whether this ambitious task can be accomplished without the powerful hand of government leading the way remains an open question. Many conservation groups believe that, at best, a river cleanup needs both a tough government presence and a committed community.

Without either, the groups said, results are often blurred.

"Action can be pushed by citizens — and should be pushed by citizens. But a weak state or local government presence can only hope to produce a holding pattern, we've found," said Victor McMahan, director of urban rivers programs for American Rivers, a national environmental organization in Washington.

Even project leaders are anxious. Asked if the Elizabeth can be seriously cleaned up without stricter regulations and the threat of government sanctions looming over the heads of would-be polluters, Mayfield smiled.

"That's a good question," she said. "We certainly hope so. And I can tell you we're certainly going to try."

Robert Hale, an environmental chemist and associate professor at the Virginia Institute of Marine Science, who also participated in the project, believes the citizen-led effort will lead to significant improvements. But he remains a realist.

"I think what we'll see is that there will always be severely degraded sections of the river," such as the Southern Branch, Hale said. "But I also think other sections can be improved, and improved quite extensively, to the satisfaction of even the most green of advocates."

government land users in the watershed by the year 2005.

6. Reduce pollution from stormwater runoff to the maximum practical extent.

7. Identify and correct inadequate sanitary collection systems, to reduce human health risks and ecological risks from fecal coliform bacteria in the Elizabeth River.

8. Reduce TBT — the ship-hull paint ingredient that minimizes barnacle encrustation — to non-toxic levels in the Elizabeth River waters and sediment, while enhancing the opportunity for continued competitiveness of Virginia's shipping, shipbuilding and other related businesses.

9. Promote mass transit and alternate transportation, based on a recognition of automotive usage as a major source of pollution in the Elizabeth River.

10. Enhance compliance with existing regulations.

11. Enhance marketability of Hampton Roads through achieving a cleaner environment, working with localities and the Chamber of Commerce's Plan 2007.

12. Increase public access to the Elizabeth River for the purpose of increasing appreciation of the river and support for restoration.

13. Remove abandoned vessels and pilings, where possible also conserving or replacing habitat.

14. Establish and maintain an Elizabeth River monitoring program and data bank to provide the scientific foundation for protecting, restoring and sustaining living resources and human health in the Elizabeth River watershed.

15. Determine the ecological effects of Craney Island operations on the Elizabeth River, with the purpose of reaching consensus among interested parties about best management practices and remediation needs. Craney Island is a repository for dredge spoils.

16. Develop and implement a "load allocation approach" as a voluntary tool for making more informed, most cost-effective decisions on how to manage the Elizabeth River.

17. Develop a nutrients task force to establish Elizabeth River nutrient goals and bases for goals, and to recommend control measures needed to achieve goals.

18. Build strong partnerships between the Elizabeth River Project and all public and private authorities relevant to this plan, for the purposes of ensuring public input and support; achieving environmental equity; and promoting speedy, effective implementation and enhancing regional watershed planning.

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The Watershed Action Team

The Elizabeth River Project's Watershed Action Team envisions a river that:
~ **Nourishes and sustains** a wide variety of economic and public uses,
~ **Supports** a healthy and diverse ecosystem, and is
~ **Actively and responsibly managed** by an educated citizenry and a partnership of river users.

Vision statement, June 12, 1995

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